Electrical World

SEPTEMBER 6, 1941

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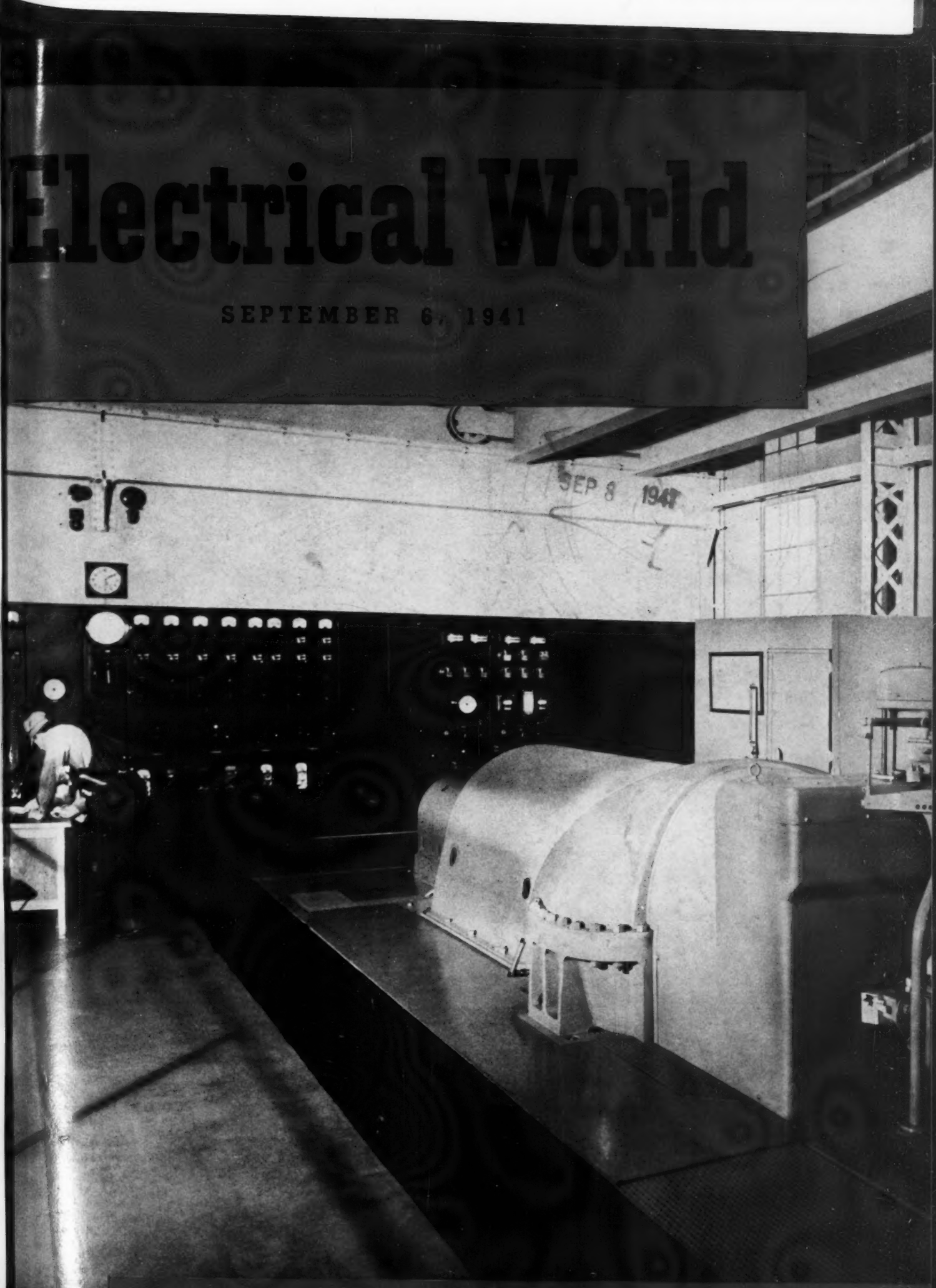

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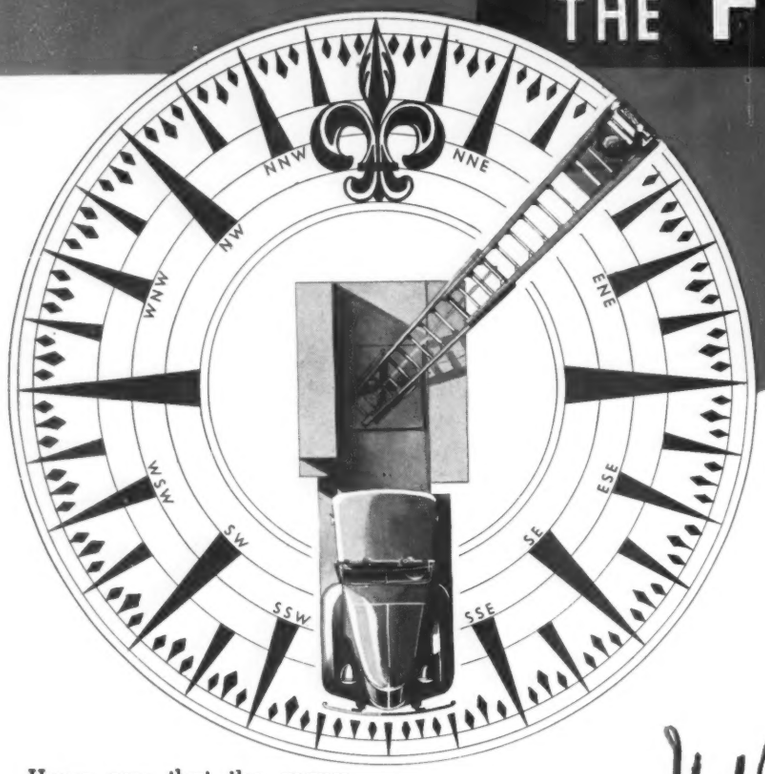

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JAMES H. McGRAW, Jr.....President
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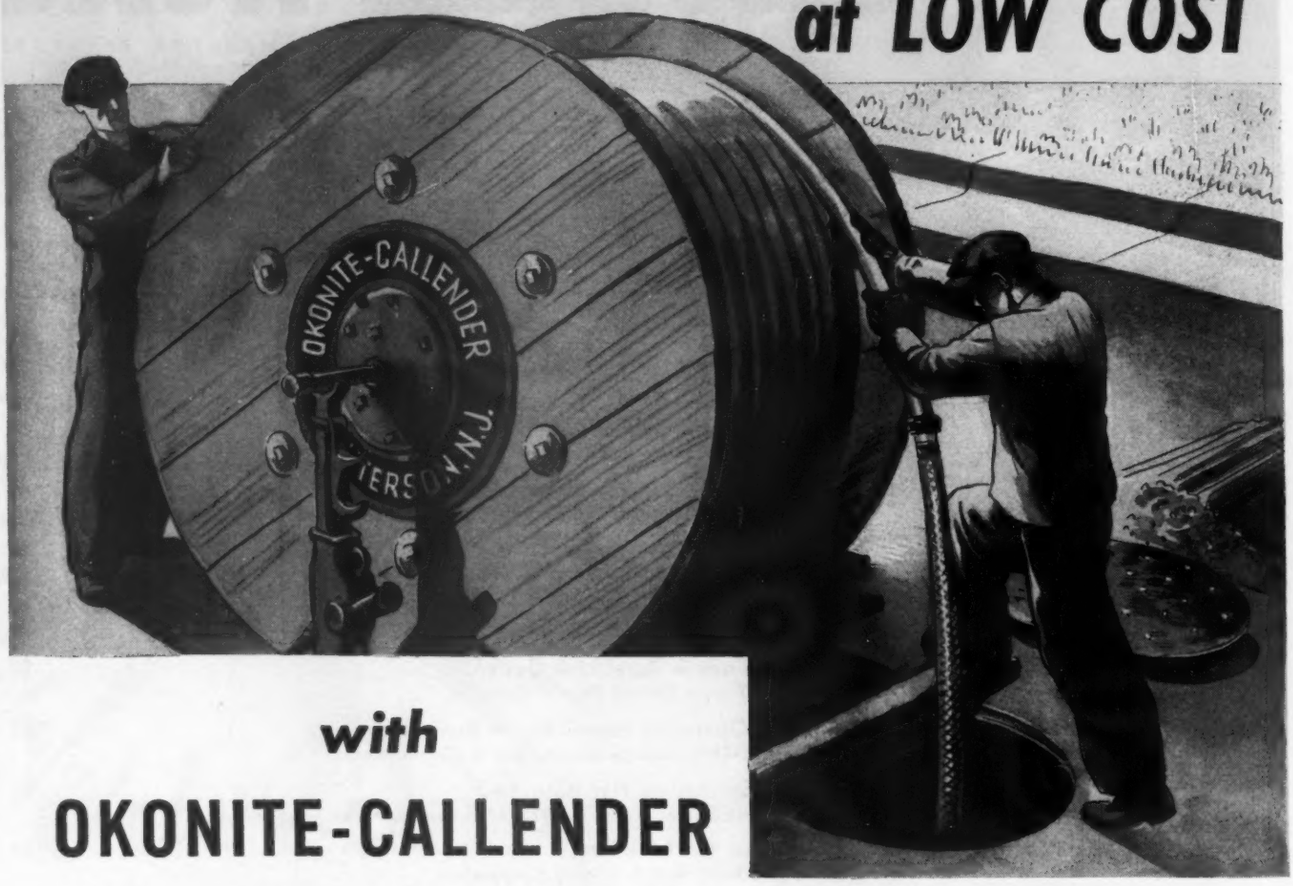

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Tomorrow May Be Too Late

Hitler has been able to inspire in the German people a faith in his leadership that is actually religious in quality. For many Germans he has taken on a god-like aspect and they worship as well as follow him. The dying soldier, so the stories go, uses his last breath to "Heil Hitler."

In communism, too, the religious quality of faith is plain. There is more than a suggestion in the stories of meetings of comrades in their homes of Saint Paul's "two or three gathered together," by which Christianity grew despite all efforts to stamp it out.

The large benevolence of the ideals of communism, promising more than selfish man can deliver, and the supreme selfishness of Hitlerism rest on the same foundation, which is faith, belief that what is promised will be won.

These faiths, these beliefs, are in promises alone.

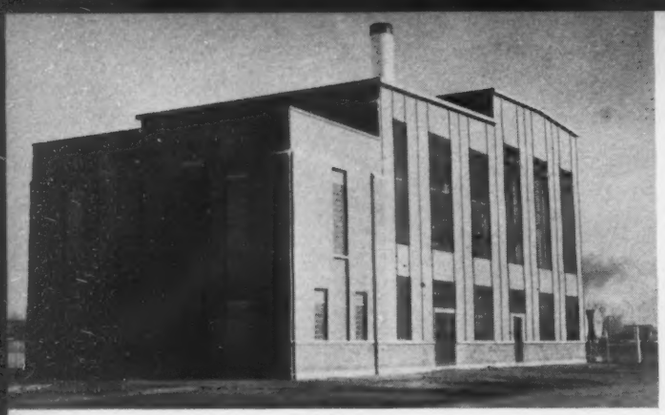
On the other hand we, who have not just promises, but actualities, as a foundation for faith, are lacking in it because the doctrines and accomplishments of a free society have not been preached to us in our generation and we have forgotten them from the days of our fathers. And, not having faith, we see those doctrines abandoned, those accomplishments denied, and we make no, or only feeble, protest.

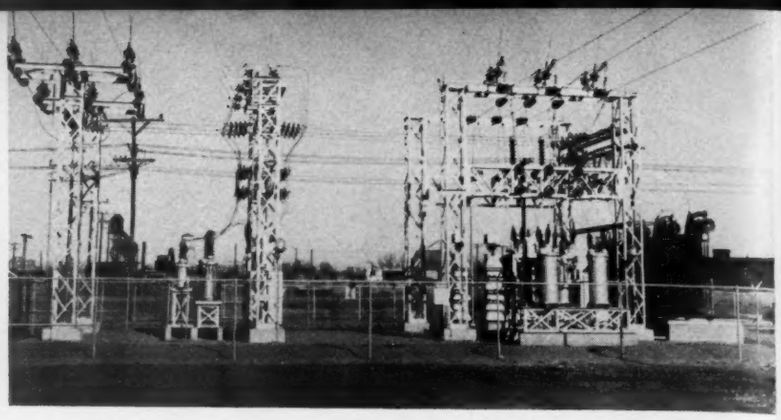
For the American people to have militant faith in their way of life the doctrines of individual liberty and of free enterprise must be preached to them. The people must be told that what they have of happiness, of comfort and of exemption from hard, grinding toil is the direct result of political liberty, of free men living under a state that is their servant and not their master. They must be told, they must be convinced, that the individual, not government, is the enterpriser, the producer of wealth and the builder of the nation. The gospel of free enterprise under democracy, what it has accomplished and what it will accomplish, must be preached to them.

A group of utility operating companies are working together to bring about through national advertising a better public understanding. How soon a program can get under way and how long it can last, how extensive it can be with respect to media, magazines and radio, and how intensive in frequency of appearance rests entirely upon the financial support this group receives from the other operating companies.

Whatever future there is in this country for private enterprise, and especially electric utilities, will be determined in the coming months by the degree to which the average citizen realizes his personal selfish interest in the benefits that accrue from private ownership.

Today is the time to start this advertising; yesterday would have been better, tomorrow may be too late.





NEW 2,500-kw., 400-lb. psi., 750-deg., single-unit Bluffs plant of Western Public Service Company at Scottsbluff, Neb., designed for one-man operation. Note permanent appearance of removable metal-clad insulated wall panels that make up three walls of boiler and turbine sections of plant. Compact 33-kv. substation with three 1,000-kva. transformer connects new plant with company transmission lines and U. S. Bureau of Reclamation

Single-Unit Plant Designed for One-Man Operation

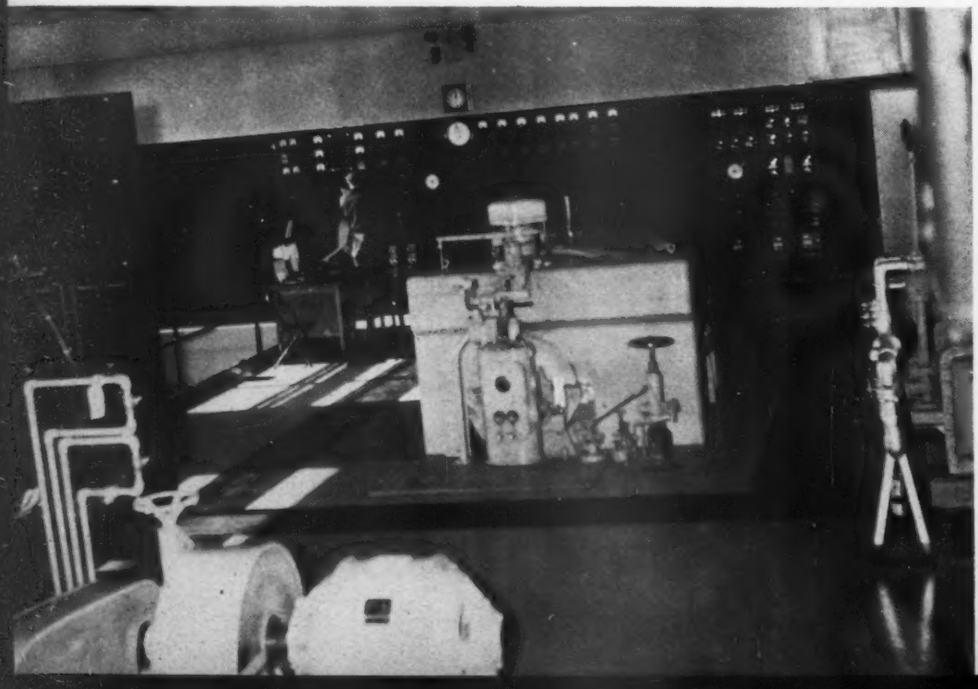
Automatic control, compact layout, one-man operation with reliability in 2,500-kw. Nebraska plant — No basement or fire walls — insulated steel-clad outside walls on three sides for easy expansion

W. P. VENABLE,* Western Public Service Company, Scottsbluff, Neb.

SYSTEM operating capacity of utilities serving predominantly rural areas, where generating stations are few, small and widely scattered, is generally insufficient to make load interchange practicable during peak-load periods. Reliability and high plant availability are, therefore, prime considerations in generating design, since each station must be considered the principal supply source for its immediate service area. Such a system is the Western Public Service Company's central and western Nebraska divisions.

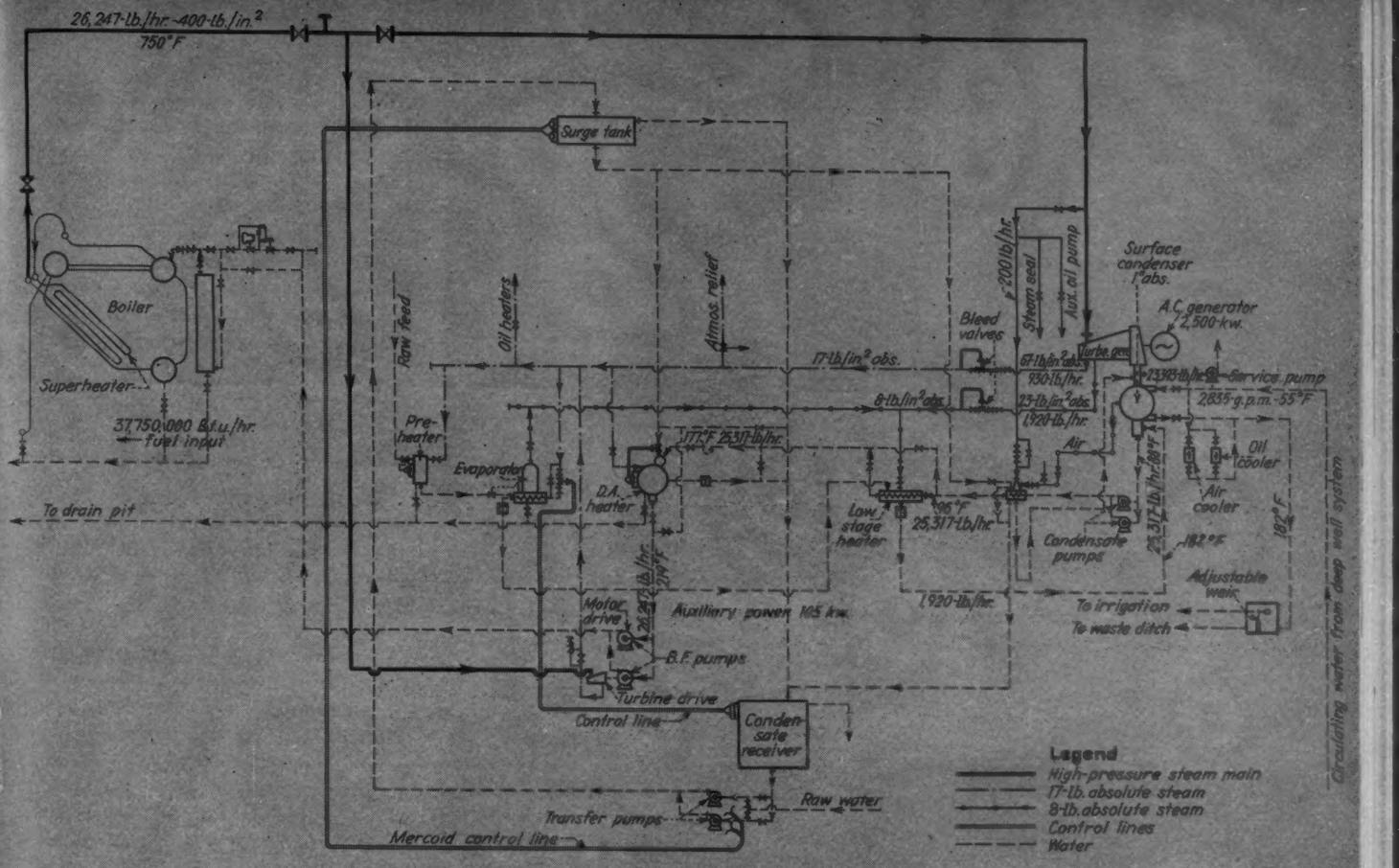
* General superintendent.

ONE OPERATOR on turbine floor controls entire plant. Visible in immediate foreground is 40-hp. motor and hydraulic coupling for I-D fan and rear of boiler control board (left). Behind the turbine, in center, is the plant switchboard



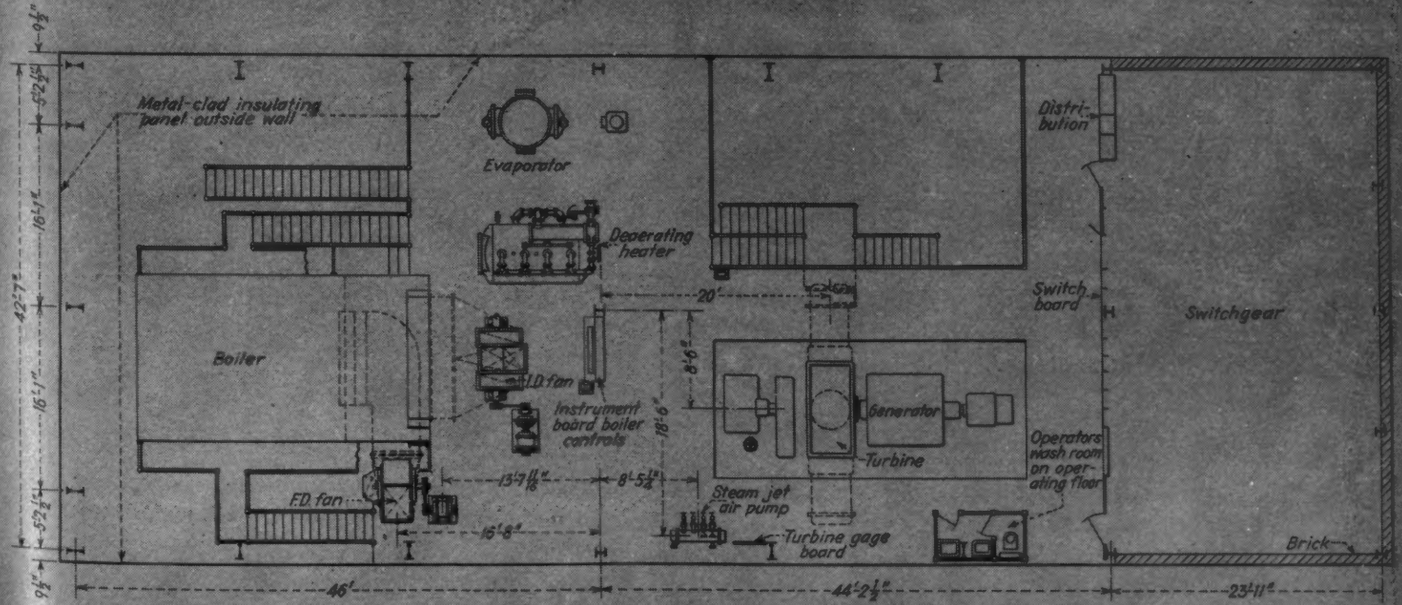
Consequently, when load conditions around Scottsbluff called for a new base-load plant to supplant eventually an existing 1,600-kw., 176-psi. plant containing a 1,250-kw. extracting turbine and two Chuse high-speed engine units, reliability was the factor that dictated most of the design innovations. Corollary objectives of low production cost and ease of expansion look to the time when the "Bluffs" plant would be expanded to carry the entire Scottsbluff and district load, currently about 2,900 kw., and the older plant could be retired with discontinuance or curtailment of central station steam heating system.

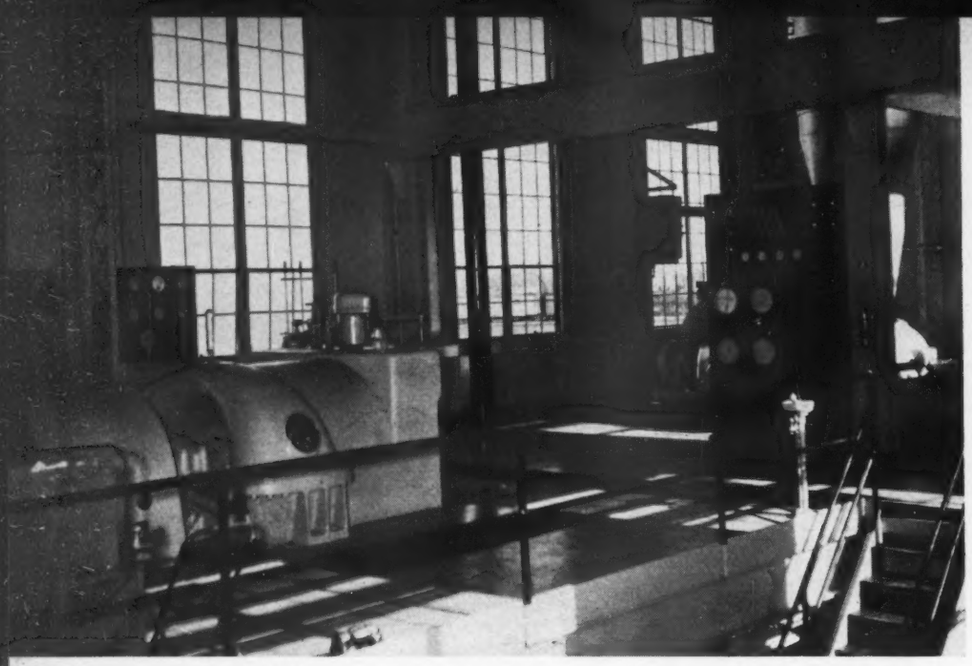
Outgrowth of these objectives has been a 2,500-kw., single-unit steam-generating station operating on steam pressure of 400 psi., 750 deg. F., using natural gas as fuel, oil as standby. Departures in the design of this plant revolve around (1) automatic features which permit operation by one man from a centralized "station" where boiler controls, turbine gage board and electrical switch-



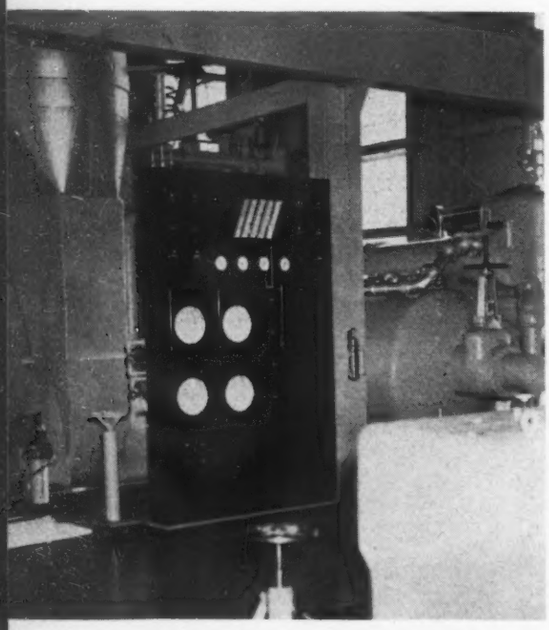
HEAT BALANCE DIAGRAM FOR BLUFFS PLANT—Evaporator, evaporator preheater and turbine-driven feed pump are not included in heat balance. When evaporator is operated a larger quantity of 17 lb. psi. steam will be bled and a lesser quantity of 8 lb. steam required. When turbine-driven feed pump is operated less 17 lb. psi. steam and less auxiliary power will be required. In either case the resultant over-all heat rate will be somewhat higher

PLAN VIEW of station at operating floor





TURBINE GAGE BOARD (left), boiler control panel (right) and electrical switchboard (not in picture) are all visible to station operator



BOILER CONTROLS, indicating and recording instruments, signal lamps and push-button controls are centralized on boiler instrument panel. Visible behind panel at left is induced-draft fan and base of stub stack, at right in background are deaerating heater and evaporator. Pictures taken from turbine end of unit

board are in view at all times. (2) Unique all-above-ground building construction with three outside walls of novel, removable insulated steel building panel (1 in. thick), permitting quick, easy plant expansion. (3) Conspicuous absence of curtain walls or isolating partitions. (4) Automatic correlation of circulating water flow (pumped from deep wells) with station load. Stearns-Roger Company, Denver, Colo., was the contractor on the job and collaborated on choice and location of equipment.

Cost $137 per Kw.

Cost of the 2,500-kw. plant, which is on a 2½-acre fenced portion of a company-owned 8-acre tract of land on the outskirts of Scottsbluff, was $343,400.61. This figure includes land, building equipment, 22,000 gal. standby oil storage tanks, 33-kv. substation and transformers. Of this, the substation cost $35,518.27.

Both the Bluffs plant and the existing Broadway 1,600-kw. plant are tied in with three other major base-load stations in western Nebraska on a 33-kv. transmission system. These plants are Sidney, 1,250 kw., Chadron, 2,920 kw., and Ogallala, 1,645 kw. Also tied in on the 33-kv. system is the U. S. Bureau of Reclamation, from which the company has purchased power since 1928. Point of interconnection is at Gering, Neb., 2 miles from Scottsbluff. Connections between the Bureau of Reclamation, the two stations at Scottsbluff, and the 33-kv. transmission system are shown in an accompanying diagram.

Water shortage has for the past six years made it impossible for the Bureau of Reclamation to supply firm power throughout the entire year due to the necessity for storing water, except during irrigation periods. This was a factor in the decision to build a new station in Scottsbluff.

Layout of the plant further fosters convenient operation by one man and simplifies expansion to accommodate future units.

The building occupies an area roughly 45 x 117 ft. and has a cubic volume (below roof trusses) of 179,630 cu.ft., or 71.9 cu.ft. per kw. based on 2,500 kw. rated capacity. Allocation of space in the building to different functions is as follows:

Boiler section ..	86,900 cu. ft.	34.8	cu. ft./kw.
Turbine section ..	67,800 cu. ft.	27.1	cu. ft./kw.
Switch room	14,600 cu. ft.	5.85	cu. ft./kw.
Shop	6,065 cu. ft.	2.42	cu. ft./kw.
Office	2,545 cu. ft.	1.019	cu. ft./kw.
Locker room	1,720 cu. ft.	0.69	cu. ft./kw.

Being without basement, the plant is entirely above grade. Condenser and firing floor are substantially at ground level, with the main operating level 14 ft. above. As can be seen in the drawings, the building is devoid of isolating curtain or fire walls and the most remote operating point in the station can be reached by the operator from the operating floor in a matter of seconds. From his station on the operating floor, as is shown in the accompanying illustrations, the plant switchboard, boiler control and turbine gage board are in view at all times.

Unique feature of the building construction is that the portion of the three building walls for the boiler and turbine sections are of removable Truscon metal-clad insulating panels only about 1 in. thick. Panels are joined to each other tongue and groove fashion and bolted to the building steel. In expanding the plant in any of these directions it would only be necessary to disconnect panels from the building steel, extend the structure and reinstall the panels. Heat insulation, sandwich style, between two sheets of metal make up the panels and is sufficient to prevent excessive heat loss from the building. Only the switch room, office and shop sections are of brick.

Nearby Fuel Supply

Location of the Bluffs plant, immediately adjacent (within 200 ft.) to a natural gas pipe line and within 1,000 ft. of an oil refinery, and the decision to design plant for one-man operation influenced the selection of natural gas as principal fuel, oil as standby. Both oil and gas provided the low fuel cost desired for minimum operating cost. However, with the plant initially intended for one-man operation, at least until a second unit is added and the old plant abandoned, making

more operators available, gas operation is simpler. It was felt that the preheating and handling of the oil would take a single operator too far from the operating floor for best efficiency.

Gas used has a heat value of about 1,060 B.t.u. per cu.ft. and costs under 2.5 mills per net kilowatt-hour. Plant thermal efficiency at full load is 16,000 B.t.u. per net kilowatt-hour. Operating as a base-load station, plant load factor is about 66 percent.

Oil Engines Considered

Consideration of oil engines as possible prime movers for a station of only 2,500 kw. capacity was not to be overlooked. Up to this point either oil or gas engines or a steam turbine could have been selected. In making a selection between them reliability was again the deciding factor favoring turbine operation. Briefly summarized, the undesirable features involved in use of an oil engine or oil engine when modified for gas operation were: (1) An oil engine is derated when used above 2,000-ft. altitude; (2) gas and oil engines have a more or less fixed capacity, little overload capacity; (3) frequent inspection, every four or five months, is necessary; increasing outage time and reducing availability; (4) failure of gas supply would require five to six hours outage to change over to oil.

Factors favoring turbine were: (1) Reliability; (2) excellent equipment for spinning standby; (3) high (20 percent) overload capacity; (4) long life, and (5) high resale value. Although fuel cost for the turbine plant would be slightly higher than for natural gas engines with same fuel cost, the dependability was higher and it could be operated eleven to twelve months continuously without shut-down.

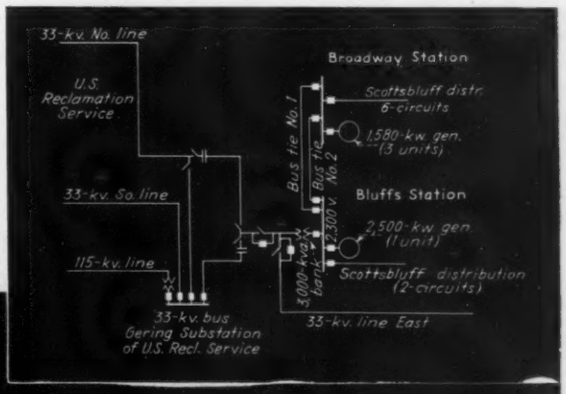
The turbo-generator installed has a nominal rating at 4,000 ft. altitude of 2,500 kw. It is a General Electric condensing unit with two bleed points at the fourth and seventh stages, where steam at 17 and 8 lb. psi. absolute is extracted for feedwater and oil heaters. The unit operates at 3,600 r.p.m. on steam, at 400 lb. and 750 deg. F. to drive a 2,500-kw. (0.80 pf.), 2,400–4,150-volt air-cooled generator. It is contemplated that within five years a second 4,000–5,000 kw. will be added to the Bluffs plant.

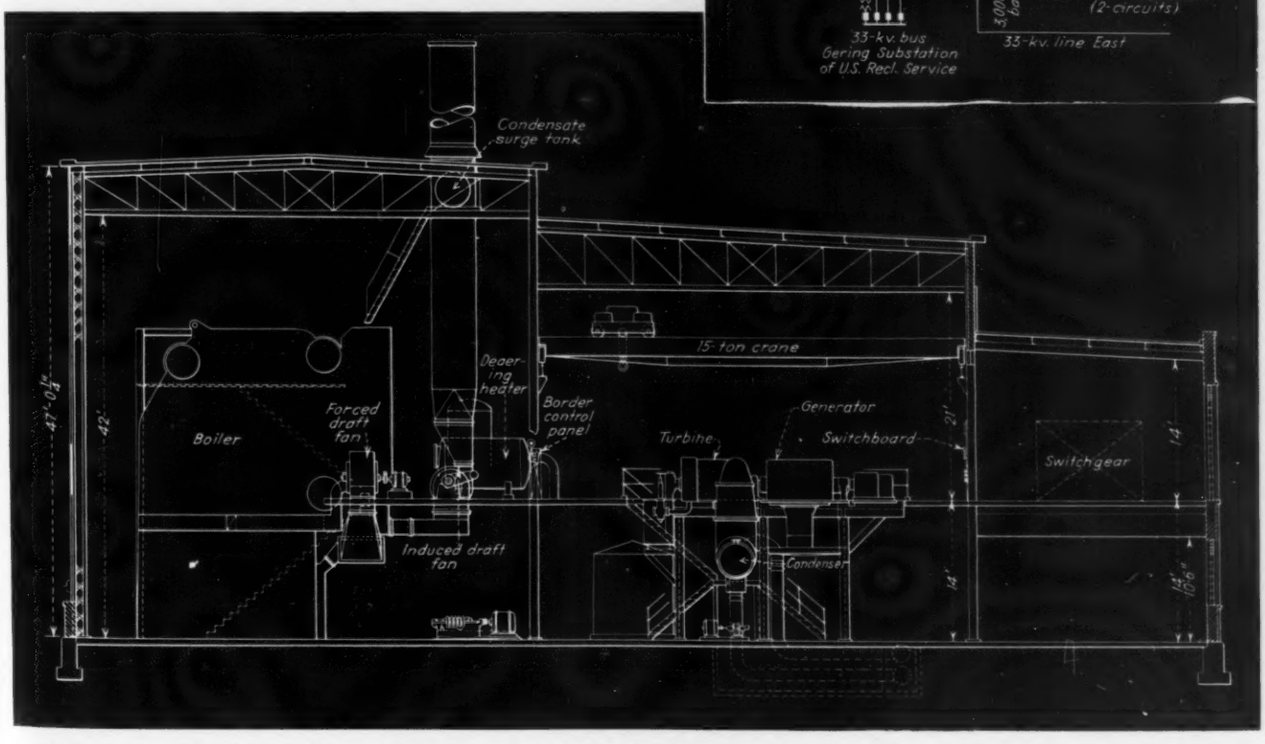
While the generator is rated 2,500 kw., practice is to operate the unit at the highest load possible without dangerous heating. Purpose of this is to supply the bulk of the 2,900 kw. Scottsbluff area load from the more efficient "Bluffs" plant, running the old 1,600-kw. plant to supply steam heat and handle peak loads. One of the station's many automatic control features provides automatic thermal overload protection of the generator. Thermocouples have been installed in the generator and connected to temperature relays which automatically disconnect the unit from the system when the danger heat point is reached. Consequently, the unit can be operated at a net load of 3,000 kw. on a substantially continuous basis without excess heating.

A second automatic control is provided in the condenser water supply

[*Continued on page* 116]

OVERHEAD TIES connect 2,300-volt station bus of new Bluffs plant with existing plant. Substation at plant site connects with 33-kv. transmission systems of company and Reclamation Bureau →





ABSENCE of curtain walls and location of entire plant on two levels entirely above grade, with centralized operating position on turbine floor, make for convenient operation by one man

Requirements Modified in the New N.E.S. Code

Loading map changed — Transverse loadings liberalized — Two specified grades for power line construction and one for communication — Rules are added for buried cable

A. B. CAMPBELL, Edison Electric Institute, and C. S. CUMMINGS, Western Union Telegraph Co.

COMPLETE REVISION of the National Electrical Safety Code was begun in May, 1937, under the procedure of the American Standards Association, with the National Bureau of Standards sponsoring the undertaking. Part 2 of the revised edition of this code, containing safety rules for the installation and maintenance of overhead and underground electric supply and communication lines in the United States, will soon be available. The most important changes will be discussed in this article.

The provisions in this revised code represent the results of the cooperative efforts and final agreement of more than 100 engineers and operating men who were members of the sectional committee (the supervisory group), the technical committees or the several subcommittees engaged in the various phases of this undertaking. The committee memberships included representatives of national and state regulatory authorities, standards bureaus, labor organizations, insurance and underwriters' groups, industrial manufacturers, communication and power utilities, street railways and railroad carriers.

While the form and arrangement of the present code, familiar to all users of this standard, remain unchanged, the revised code has been modernized to accord with the many advances in the art and practices of electric line construction and operation and developments in equipment and material that have been made since the issue of the present code in 1927. Throughout the revision an effort was made to base all changes on factual data and experience. Where

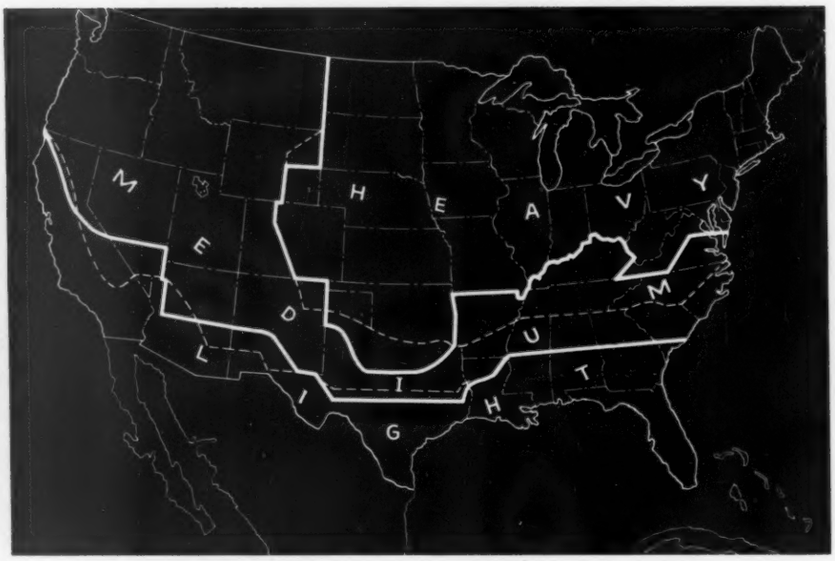


FIG. 1—Adjustments made in clearance increase increments for long spans to avoid penalizing new types of small conductors

it was indicated that present requirements were unnecessarily severe or, on the other hand, should be strengthened, the revised rules were decreased or increased accordingly. As a result of these changes, the revised code should, as a whole, provide greater safety than previous editions of the code.

Clearances

The clearance subcommittee's study of new designs of line conductors (such as three-wire strand, etc.), characteristics of conductor materials and changes in wire-stringing practices effected during recent years revealed that, while the basic vertical clearances required by the present code were, in general, satisfactory, adjustments were necessary in the clearance increase increments for longer spans and in the maximum clearance limits, particularly for some of the smaller conductors. It was also evidenced that changes were justified in the basic clearance span length limits, particularly in the medium and light loading districts.

To illustrate the reasons for these changes, the midspan sag increases of several typical conductors from their final unloaded condition at 60 deg. F., no wind, to that under full load ice and wind assumptions for the heavy loading district, with the conductors stressed to a maximum of 60 percent of their ultimate tensions, are shown in Fig. 1. Also, there are shown in dash lines (for a basic clearance of 4 ft.) the clearance increase increment and maximum clear-

ance limit specified in the present code for all conductors, compared with the several requirements for these conditions given in the revised code for certain large and small conductors.

Because of the wide variations in the sag increases of different sizes and kinds of conductors now in general use, a single clearance increase and maximum clearance limit for long spans, as specified in the present code, obviously would penalize certain conductor materials, if so placed as to safely cover all conductors. The method now prescribed, based on the maximum sag increase of any conductor concerned, under full loading or maximum temperature conditions for each loading district, is such that a reasonable and safe residual crossing clearance will obtain under loading conditions likely to prevail.

A further refinement in the revised code vertical clearance requirements permits of applying a reduction factor to the clearance specified at midspan, if the crossing occurs at some other point in the span. These factors (for the various basic clearances) were derived from the catenary curve of a suspended conductor and are a relation between the crossing conductor sag increase at midspan and those increases occurring at other points in the span.

Climatic Loading Assumptions

In 1927 the communication, power and railroad companies began a study of all glaze storms occurring in the United States, and this study was continued for a period of ten years. This extensive compilation of data consisted of individual measurements of glaze deposits on wires in each storm, usually at several different points of observation in the storm area, and the maximum wind velocity (fastest mile of the actual five-minute average velocity) prevailing coincident with each such glaze formation. The wind velocities were obtained from the records of the U. S. Weather Bureau station nearest to each point where glaze measurements were made. These data were studied by the loading subcommittee, but, in addition thereto, in its analysis of storm conditions, the subcommittee considered the loading studies of several utilities and the experience and construction practices of many operating companies in different localities. Operating experience was an important factor in establishing rational loading assumptions because of the many variable factors that influenced the effects of individual storms on overhead line construction.

The committee's analysis revealed that the present code transverse loads upon structures, due to wind pressure on the ice-covered conductor supported, assumed for the heavy and medium loading districts, were considerably more severe than the transverse loadings to which lines would generally be subjected. It was found that, in general, when large glaze formations accumulate on wires, the coincident wind pressure is relatively low. In such instances, though the vertical loads might be severe, the transverse load upon supports would be comparatively small.

The committee concluded that, while the previous assumptions on thickness of ice covering on wires in the heavy and medium loading districts were reasonable and representative, the assumed coincident wind pressure was excessive, as evidenced by the fact that in only 1 percent of the glaze storms analyzed did the wind pressure equal 8 lb. per sq.ft. (the present code assumption), and in only 10 percent of the storms was the wind pressure equal to, or in excess of, 4 lb. per sq.ft. This latter value was determined upon as a reasonable wind pressure assumption to specify in the revised code for the heavy and medium loading districts.

Although the loading data showed that in certain sections of the light loading district glaze accumulations on wires do occur, nevertheless the predominant transverse load upon lines in this district is generally that produced by high wind velocities, with no coincident ice, which create a greater load transversely than that which might be derived by assuming a representative combination of ice and wind, particularly on large gage conductors. The committee concluded that a wind load of 9 lb. per sq.ft. upon conductors, without ice covering, was a reasonable assumption for the light loading district, and this value was included in the revised code to supersede the 12 lb. per sq.ft. assumption in the present code.

Analysis of the data on loads upon conductors during glaze storms indicated conclusively that the resultant

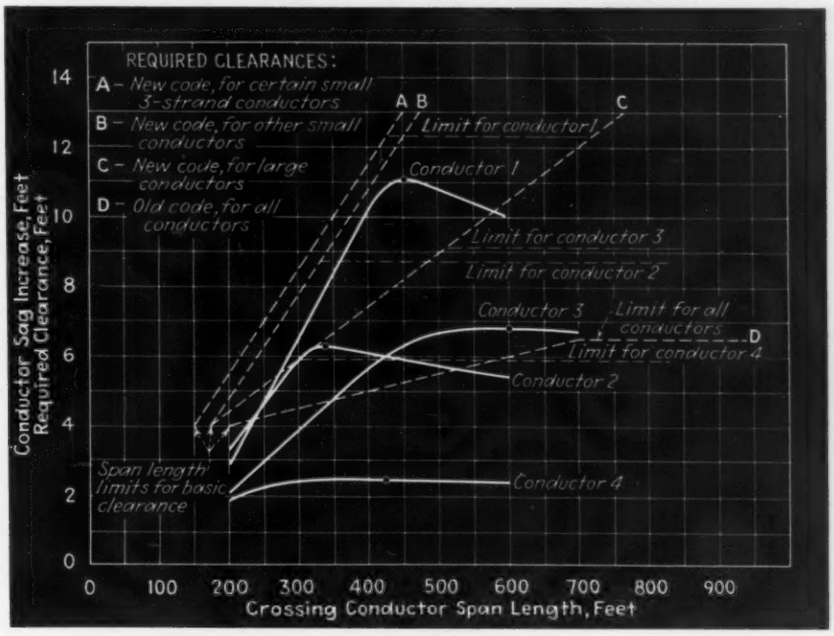


FIG. 2—Loading district boundaries are revised

Shows maximum sag increase of conductor 1 to be 11.05 ft. (designated by the dot at the peak of the conductor sag increase curve). For basic clearance of 4 ft., the maximum clearance for this conductor in spans of 425 ft. or more in the heavy loading district, with the point of crossing at midspan of the crossing conductor, would be: Maximum clearance = 4 + (0.75 × 11.05) = 12.3 ft. For any span shorter than 425 ft., the required clearance for this conductor, under the above conditions, would be that shown on slope A.

loading assumptions in the present code were representative, in that equivalent loads, due to combinations of ice and wind, or ice alone, occur with sufficient frequency and extent to warrant their being assumed in line design. However, it was considered inadvisable to confuse the issue by specifying different sets of assumptions of ice and wind for loads upon conductors than those assumed for transverse loading. Accordingly, a series of constants for the various conductor materials and the different loading districts was included in the revised code. The constant for a given conductor, when added directly to the resultant load per foot derived from the new transverse and vertical loading assumptions, will give a conductor load equivalent to that prescribed in the present code. This will permit of the continued use of conductor sag and tension charts based upon the present code loading assumptions.

The new loading assumptions for thickness of ice and wind pressure in the various loading districts were chosen with a view to recognizing those loads to which conductors and supports might be subjected with sufficient frequency and extent to warrant their consideration as being representative, rather than those extreme weather conditions that may only rarely occur. However, as explained later, to compensate for some of the loading assumption reductions in the revised code, allowable stresses in materials have, in general, been decreased so as to provide adequate strength of line construction under all conditions.

Loading Map Revised

The committee's study indicated that, in general, the use of only three gradations of loadings was adequate. The three loading districts as defined in the present code loading map were, however, found in some instances to be not in accord with experience or regulatory actions that have been taken in certain states. The revisions in boundary lines determined upon by the committee are shown in Fig. 2 by solid lines with boundaries of the present code shown in dotted lines.

This loading map is based on the frequency of occurrence of storms of different intensities and on the general operating experience of wire-using companies. Likewise, this broad, general districting is not indicative of climatic loading conditions that may prevail in certain recognized isolated areas, too small to depict accurately on the map. As stated in the revised code, however, it is expected that more detailed districting, based upon local experience, will be undertaken by each state regulatory authority.

Two Grades of Construction

The changes in grades of construction consist mainly in dropping from the revised code what were designated in the previous code as Grades A and E construction. The revised code will contain a grade of construction designated as Grade B, which, for the most part, provides requirements similar to those of Grade B in the present code, although a few of the requirements for present Grade A have been retained for the newly designated Grade B. The present requirements for Grade E communication lines crossing over minor railroads have been deleted, and all such crossings in the revised code are required to be constructed in accordance with Grade D requirements.

The over-all result of the changes in grades of construction is that now there will be only two grades for electric supply line construction where specific strengths are required and one grade only for communication lines crossing railroads instead of the two previously required. The grade of construction designated as Grade N in the present code, for communication and supply lines in situations not requiring higher grades of construction, has been retained in the revised code.

Strength of Construction

Several changes have been made in the strength requirements, among the more important of which are the following:

1. Changes in the longitudinal strength assumptions in present Grades A and B as to the number of broken conductors to be considered in line strength determinations.
2. Elimination of the differential in the maximum allowable tensions in supply line conductors under full load conditions of 50 percent of the ultimate strength of conductors in Grades A and B construction and 60 percent in Grade C, as specified in the present code. In the revised code a single limit of 60 percent is provided for the two grades of construction.
3. Modification of the methods of specifying steel strength requirements by a departure from the method of expressing these limitations in terms of allowable unit stresses to a basis designated in the revised code as "overload capacity factors," which method had been adopted earlier by the Canadian Electric Standards Association, and is thought to be a simplification of the method of specifying steel tower strength requirements.
4. Inclusion of a new requirement specifying double brackets or crossarms at all Grade B crossings where pin type construction is employed.
5. Reductions in the allowable working stresses for transverse loads to compensate for the reduced transverse load assumptions in the revised code.

As regards "5" above, the changes in allowable stresses were made in such a way as, in general, to keep the over-all transverse strength requirements as specified in the present code substantially unchanged. In some instances these requirements were increased over the corresponding present requirements, but taking into account the elimination of the present Grade A strength requirements, the net result is, in the heavy and medium loading districts, a reduction in strength requirements in several instances for the highest designated grade of construction. In the light loading district, however, the new strength requirements will provide over-all transverse strength equal to that of Grade A under the present rules and the strength requirements for Grade C lines in such areas have been increased.

Perhaps one of the most important changes made in strength requirements is the inclusion in the revised code of stringing and final unloaded tension limits for overhead line conductors, which limiting conditions were not recognized in the present code. Their inclusion is felt to be of considerable value in alleviating conductor failures due to fatigue or vibration. These limits require that no supply line conductor in Grades B or C construction will have a stringing tension in excess of 35 percent of its ultimate strength, or a final unloaded tension in excess of 25 percent of its ultimate strength, except that 30 percent is permitted for three-strand conductors.

Miscellaneous Provisions

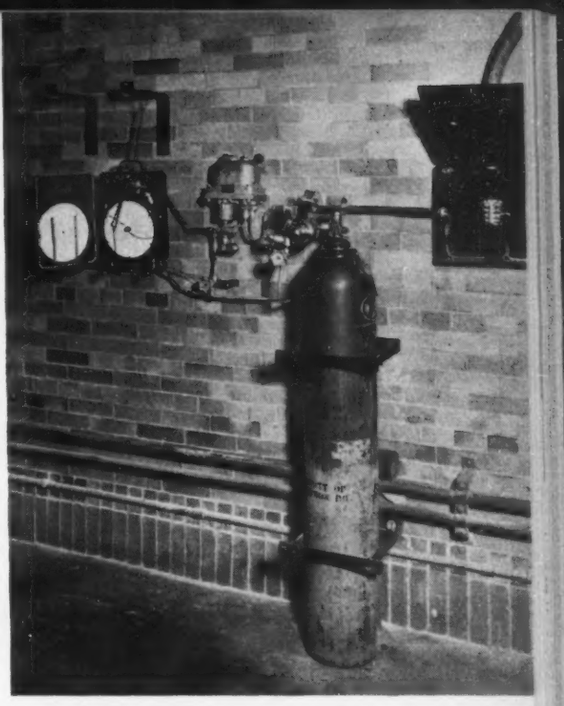
Throughout Part 2 of the revised code where the term "voltage" appears, it has been made clear whether in each requirement "voltage to ground" or "voltage between conductors" was intended, except in a few instances where the meaning was con-

[*Continued on page* 56]

Gas-Filled Cable Aids System Supervision

Due to reduced insulation thickness, cable also permits added capacity in existing duct systems over that with solid cables—Installation and maintenance simpler than for oil-filled types

E. R. THOMAS, Consolidated Edison Company of New York, Inc.



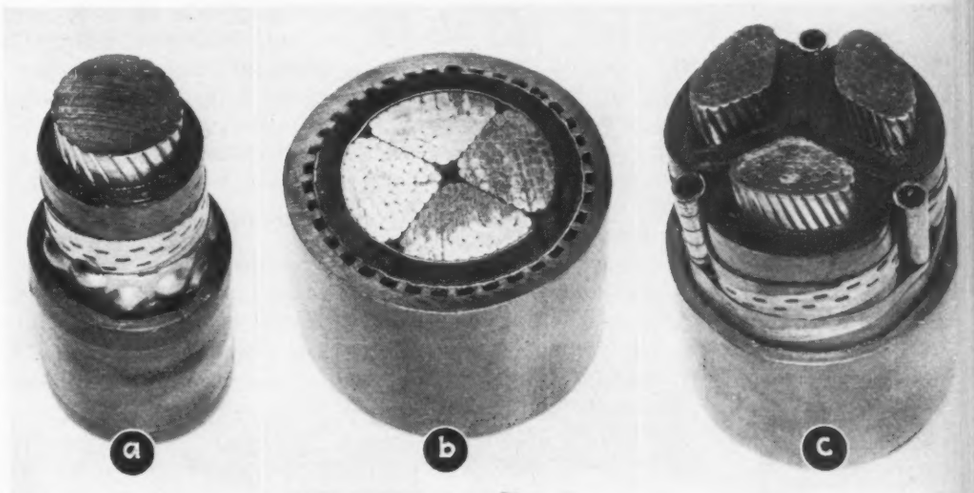
GAS ALARM at each station warns of a drop in pressure due to any cause through Autocall board

Pressure on the cable system normally shows a variation from 10 to 12 lb. in changing from no load to full load. In this view of a feeding point, right to left, are pressure alarm relay, high-pressure bottle of nitrogen with reducing regulator and a graphic meter, temporarily installed to provide a check on the cable operation.

SUPERVISION it affords over the tightness of the system has been the outstanding advantage of low-pressure gas-filled cable in our experience (see ELECTRICAL WORLD, March 11, 1939, page 92). Nitrogen gas at 10-lb. pressure is fed into the cable at one end only. In June, 1938, we installed 28,500 ft. of three-conductor, 15-kv. cable, adding 40,000 ft. of 27 kv. about a year thereafter. The longest operating feeder measures approximately 7,500 ft.

To date there have been no electrical failures in this cable system. There have been a few gas leaks indicated by the alarm system since the cables have been in service. Some of these have been due to gas leakage at terminal gaskets and at fittings and in two cases were due to damaged cable sheath in a duct. On one occasion the alarm system notified of a contractor digging into the cable sheath with a compressed air drill but not causing electrical failure. A section of the cable inspected after a year's operation showed that the cable had remained stable and that no wax had formed.

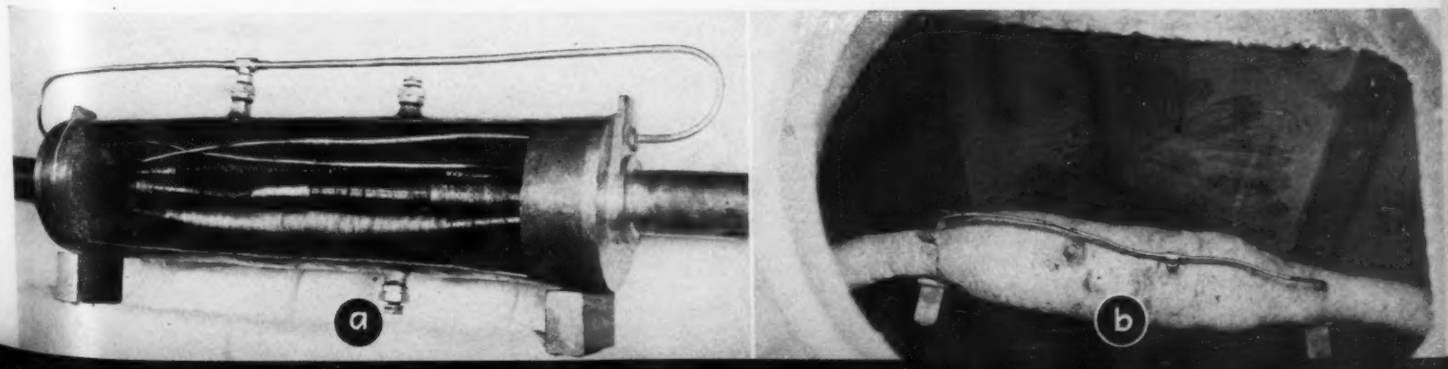
Installation of the gas-filled cable is generally similar to that for solid cable; since the gas in the cable is compressible, no reservoirs are used, as in the case of oil-filled types. Present over-all cost is somewhat higher than for solid-type cable, but it is believed that this new type cable possesses certain operating advantages which would tend to reduce electrical failures.



GAS-FILLED CABLES may take various forms

In the single-conductor, 15-kv. gas-filled cable (a), manufactured by General Electric, the embossed spacer tape provides a gas channel between the sheath and cable insulation. Fluted lead in (b) manufactured by General Cable, provides the gas channel in this single-conductor, 15-kv. cable. The three-conductor 500,000-cir.mil, 27-kv. cable (c), manufactured by General Electric, resembles oil-filled types, except that the channel spaces are filled with nitrogen under pressure. Whatever the construction, gas-filled cable requires less insulation for a given conductor size than solid types, hence permits additional capacity in existing ducts.

CABLE JOINTS for gas-filled cables resemble those made on oil-filled cables except that no compounds are used. At each joint (a) a section of the gas containing copper tube surrounding the conductor is brought out and a T-fitting attached. This fitting provides a means of location or isolation o leaks by the drop-of-pressure method. After arc-proofing has been applied—portland cement and sand—the completed joint has the appearance of (b



Secondary Network Planning—III Characteristics, Alternatives

Ways of clearing secondary faults, determination of feeder loading, function of the limiter, value of miniature replica

H. G. BARNETT, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

THE CHECK STUDIES prior to making complete studies of the final network plan will eliminate intolerable overloading of transformers and secondary mains by indicating the remedy for bad conditions. The summaries,† such as Figs. 6 and 7, show the load characteristics of the network. The results of the load studies, Fig. 5, show the loads for which the primary feeders must be designed. The summary of minimum fault currents, Fig. 9, indicates the ability of the network to clear faults; there may be sections where it is impossible to be sure of clearing the worst type of fault. Check studies for selecting a network plan may show that a change of conductor size is desirable to improve the fault-clearing ability. But in many plans, due to wide spacing of transformers in the fringe areas of a network, it is impossible to get ample fault current in all mains for clearing all faults with any practical design.

Clearing Secondary Faults

Tests and calculations have shown that the minimum currents shown in the table are required to burn clear the most severe type of fault. Such a fault is one where the current and thermal capacity of the fault is greater than that of the conductor itself, making it necessary to fuse the conductor on each side of the fault. The probability of such a fault is rather small and the large majority of faults on network secondaries will clear with much smaller currents than those shown in the tabulation. The values for underground circuits are for either lead-covered or non-leaded cables. Values for overhead circuits are for weatherproof conductors on racks.

None of the sections of main in Fig. 9 have less than the 1,700 amp. required to burn clear faults on No. 3/0 overhead conductors. However, fault studies will generally show that it is necessary to make some special provision in a few sections of network main to make sure of clearing the most severe faults.

Low-Current Faults

There are three general methods of taking care of cases where there is insufficient current.

1. One is to rely on cutting clear sections of main in the infrequent cases of faults that do not burn clear. Cutting off conductors carrying fault current is not desirable from the standpoint of safety.

2. A second method is to install limiters, fusible sections connected in the conductor, that will clear the section of main on which a fault does not burn clear in a reasonable length of time. Limiters should be carefully applied so that they not only protect the cable insulation but also coordinate properly among themselves and with other protective devices, such as the network protector relays and back-up fuses.

3. The third method can be used where parallel conductors in each phase are used instead of a single larger conductor; the method is to tie the parallel conductors together at frequent intervals.

The effect of tie points along parallel conductor mains is illustrated in Fig. 10. If a fault occurs on one conductor of a parallel conductor main near a junction with other mains there will be enough current in a well-planned network to burn off the conductor between the fault and the adjacent junction point. If there are no tie points, as in Fig. 10 (b), the fault current from the main, I_F, may not be enough to burn clear the fault at the end of the conductor; the impedance from transformer 2 to the fault is high and that transformer does not aid materially in clearing the fault from the main side. But if the parallel conductors are tied together at regular intervals, as in (c), the impedance from transformer 2 to the fault is decreased so that transformers 1 and 2 together supply enough current to clear the fault on the main side.

Clearing Ability

The currents shown in Fig. 10 are calculated for the conditions shown. The current to a fault at the end of a 500-ft. 500,000-cir.mil secondary main, Fig. 10 (a), will be 4,250 amp., or only 85 percent of the 5,000 amp. necessary to clear a solid fault on that size conductor. If, as in (b), two No. 4/0 cables, without tie points, are substituted for the 500,000-cir.mil the fault clearing ability is improved; however, there is still only 98.2 percent of the 2,900 amp. required for the worst fault; obviously, the probability of a fault not clearing is very remote. But if, as in (c), the two paralleled No. 4/0 conductors are tied together at the midpoint of the sec-

*Central station engineer.

†In preceding article ("Electrical World," August 23, 1941), which discussed feeder connections and calculator studies.

tion, the available fault current to the fault shown is increased to 149.2 percent of the 2,900 amp. required; this provides a wide margin of safety.

It has been found that in the case of two No. 4/0 conductors per phase and 300-kva. transformers 100- to 150-ft. intervals are short enough to burn clear a fault such as shown in Fig. 10 (c), even on mains as long as 1,350 ft., which seldom occur in secondary networks. The effectiveness of this method depends on there being two branches of the main each in a separate duct to prevent a fault in one branch from communicating to the other. Usually these tie points are provided automatically by service taps along the mains; on a parallel conductor main the branches should be tied together at service points because of the improved voltage regulation and decreased losses in the main.

Primary Feeders

Primary feeders to a secondary network operate essentially as radial circuits and can be designed in the same manner as a radial feeder. The total load on a feeder can be determined by summing up the loads of the individual transformers on that feeder and applying the proper diversity factor. The total feeder load must be determined for each emergency operating condition to determine the maximum on each feeder. The sum of the maximum loads on transformers connected to feeder A, as shown in the summary of maximum loads, such as Fig. 6, is a fictitious load and is larger than the actual maximum load. A diversity factor of 1.15 to 1.2 can be applied to the sum of the transformer loads on a feeder to arrive at the feeder load. Each primary feeder must have sufficient carrying capacity.

If the primary circuits are long, voltage regulation may determine the minimum size of the conductors; the voltage-regulating equipment used will also be a factor in determining the permissible voltage drop in the primary circuits up to the first network transformer. Between the first and last transformers on a feeder the drop should be limited to 1 to 2 percent because voltage-regulating equipment cannot compensate for this drop regardless of where constant voltage is maintained.

The voltage of the primary feeders depends on the available supply where existing substations are to be used. Frequently networks are started in small cities with existing 2,300-volt feeders, which are later changed to 4,000 volts when the load becomes greater than the capacity of the 2,300-volt circuits. Voltages in the 11-, 13.2- and 22-kv. classes are being used in 57 of 136 installations in operation in 1937. Use of the higher voltages has permitted supplying network systems directly from generator buses in many cases. This saves the cost of intermediate voltage transformations and the corresponding losses.

In overhead networks the primary feeders may be open wire, overhead cable or underground cable. Where several feeders are used to supply the network it is desirable to use overhead or underground cable to avoid congestion on the poles, because two or more primary circuits may have to follow the same route in some places. In underground systems the primaries are cable.

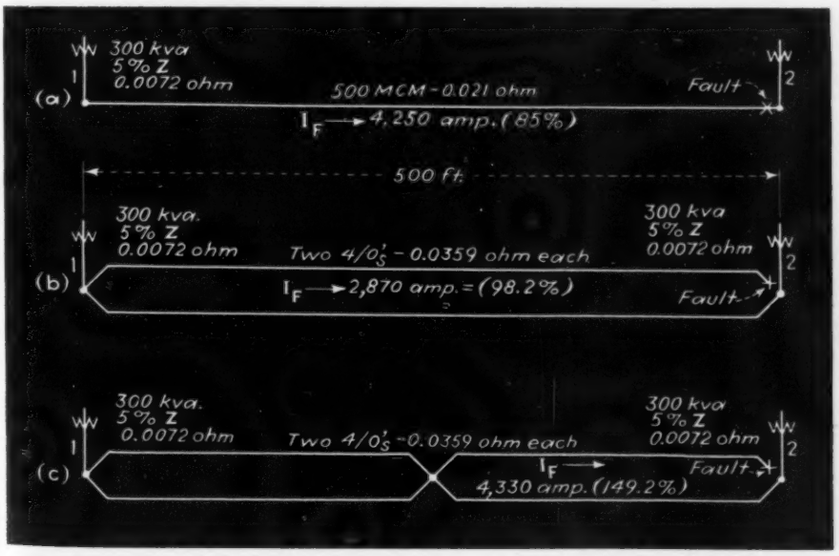


Fig. 10—Tying together paralleled conductors in a secondary main assists the burning off of faults

Minimum Fault Current in Amperes Required in Each Conductor to Burn Off a Solid Fault on Single Conductor Cables

Conductor Size	Overhead Circuit	Underground Circuit
1	1000	1600
1/0	1200	1800
2/0	1400	2100
3/0	1700	2500
4/0	2100	2900
250 MCM	2300	3200
350 MCM	3000	4000
500 MCM	4000	5000

Alternate Planning Methods

So far only the use of the standard d.c. network calculator has been considered. For those cases where a network calculator is not available there are two alternative methods of planning a network. The first and more preferable one is to construct a miniature system to simulate the loads and circuits of the estimated plan of the network. (See ELECTRICAL WORLD, September 7, 1940, page 50).

The other alternative method is to estimate load division and fault currents by inspection or by approximate calculations wherever possible. The preliminary procedure is the same as that described for the use of the network calculator. When the preliminary estimated plan is developed the various emergency operating conditions are considered, and the division of the loads, where transformers are out of service, among those transformers in service and the various secondary mains is estimated by inspection.

Estimates should be based on a consideration of the relative lengths and impedances of the various mains and transformers. These estimates will develop a set of load division characteristics similar to those obtained from the network calculator and may be summarized in the same way as shown in Fig. 6. Fault currents can be calculated approximately by considering only the sections of mains adjacent to the fault point and the transformers at the far ends of these sections. The accuracy of this method depends upon the experience and judgment of the planning engineer, but at the best the accuracy of the resulting plan cannot be known definitely until the network is built.

Cost Considerations in Rural Line Design

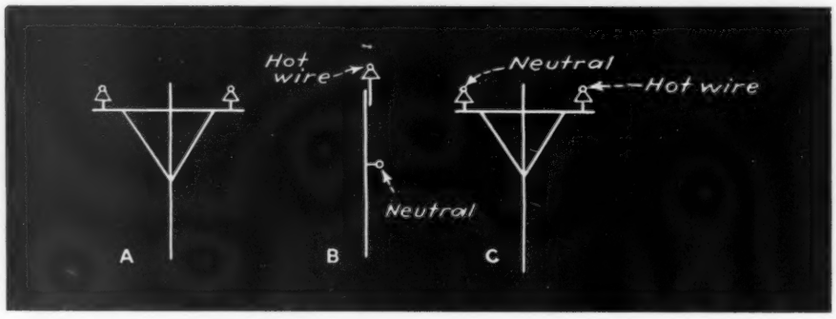
Fifteen companies in five Midwestern states give cost and design information on typical rural lines — One-mile tangent line basis

E. L. WEBER, Empire District Electric Company, Joplin, Mo.*

TO EVALUATE some of the more important factors affecting the relative cost, as well as the physical and electrical arrangement, of the various types of rural distribution lines used by Middle Western utility companies, the overhead lines committee of the Missouri Valley Electric Association recently asked 21 companies in five states of Missouri, Kansas, Nebraska, Iowa and Oklahoma to supply detailed information on cost and design of a "typical" one-mile tangent line of single phase.

The resulting information, supplied by the fifteen reporting companies, as to cost, configuration, conductor types, loading, poles, span lengths, customer taps, service arrangements and investments, is summarized in the accompanying tables and discussion.

Cost data presented, however, do not reflect the actual cost of the particular company involved, since to arrive at a sound basis of cost comparison a unit system of construction costs was applied, using the costs of the author's company as a basis.



TYPICAL configuration for single-phase rural lines

Configuration

Three types of construction (see sketches) are in general use and will be here designated as types A, B and C. Type A is used on delta or non-grounded lines with the conventional crossarms and braces and with the conductors carried on the end pins of the arm. Type B, commonly referred to as R.E.A., has the "hot" wire on a pole-top pin and the neutral on various types of neutral supports bolted to the pole approximately 4 ft. from the top. This type of construction is used only on wye or grounded neutral type lines. Type C is the same as type A except that it is used on wye or grounded neutral type lines. Here neutral insulators are of lower voltage, usually of the secondary class, this being the simplest method of attachment to pin.

In considering the cost that must be allocated to configuration, type A is, of course, the most expensive. Little, if anything, could be used to lower this cost as long as the line is delta connected. Only solution would be to convert the line so that future extensions could be built of the type B or C. As long as it remains delta connected, this type must be maintained, and hence the advantages and disadvantages will not be discussed.

Type B configuration has the lowest original investment. To determine this difference, consider the lines as built by the Empire District Electric Company and the St. Joseph Railway, Light, Heat & Power Company. In these two cases span length and pole class are the same, but the conductor is different, the former using type C and the latter Type B. If the difference in cost of conductors, figured as type B construction, as against $621 for type C. This is a difference of $20 per mile in favor of type B construction. In addition to giving a somewhat lower original investment cost, type B construction gives a transversely stronger line as indicated by the summary. This is due to one conductor being carried lower on pole.

On the basis of the above figures the author's company has built a good many miles of this type of line in the first few years of its introduction. After a few years of operating experience, the fact was brought home that not always was the original cost figure alone to be considered. It was discovered that this type of line is probably the most unsafe, as far as we are concerned, from an operating and maintenance standpoint.

All but two companies report construction as built to conform to heavy loading and conductor strung to tensions that will give 60 percent of ulti-

* Adaptation of a paper presented at recent engineering conference of the Missouri Valley Electric Association, Kansas City.

Table I—One-Mile Tangent Primary Farm Line

Company	Location	Voltage	Connection	Loading	Av. Span Lgth.	Conductor	Config.	Pole Height	Pole Class	Transverse Safety Factor	Customers Per Mile	Cost Per Mile
Peoples Light Company	Davenport	6,900	Delta	Heavy	352	6A	A	30	CP 6	2.23	3	649
Peoples Gas & Electric	Mason City	6,900	Delta	Heavy	293	6A	A	30	WRC 7	2.12	2	724
Kansas Electric Power	Leavenworth	6,900	Delta	Heavy	310	4AL	A	30	5	2.87	3	619
Iowa Electric Light & Power	Cedar Rapids	6,900	Delta	Heavy	330	4AL	A	30	WRC 6	2.33	2.25	613
Iowa–Nebraska Power	Lincoln	6,900	Delta	Heavy	229	#6 Cu.	A	30	CP 7	2.73	2.33	728
Iowa Public Service	Sioux City	6,900	Delta	Heavy	229	8A	A	30	CR (?) 6	3.37	2.5	793
Iowa Public Service	Waterloo	6,900	Delta	Heavy	251	HiTenso #6	A	30	WRC 5	3.73	3.26	802
Iowa City Light & Power	Iowa City	4,800	Delta	Heavy	310	6A	A	30	WRC 5	2.91	3	720
Oklahoma Gas & Electric	Oklahoma City	6,900	Wye	Medium	377	6A	B	30	CP 9	3.62	3.62	578*
St. Joseph Ry., Lt., Ht., & Pwr.	St. Joseph	6,900	Wye	Heavy	330	6A	B	30	CP 6	2.57	6	651
Missouri Gas & Electric	Lexington	6,900	Wye	Heavy	330	4AL	B	30	CP 5	3.12	3.5	578
Kansas Gas & Electric	Wichita	6,900	Wye	Heavy	528	3–#10 CW	B	35	CP 6	1.27	3.68	521
Nebraska Power	Omaha	7,620	Wye	Heavy	387	Amer. #12	B	35	CP 7	1.75	2.5	532
Kansas City Power & Light	Kansas City	6,900	Wye	Heavy	406	# 4 AL	C	35	WRC 7	1.5	2.56–15.1	555
Empire District Electric	Joplin	6,900	Wye	Heavy	330	8A	C	30	WRC 6	2.41	3.59	621

Notes — Not including tree trimming or R/W. Two down guys per mile. Two extra height poles per mile. No grounds except as noted.
* Ground on every pole.

mate under that loading. The Oklahoma Gas & Electric Company specifies those conditions under medium loading. Kansas City Power & Light Company strings to 70 percent of ultimate under heavy loading.

Transverse factors of safety, given in the summary, were calculated from the class poles as given, not all of which were defined in the bill of material submitted. From this column it may be seen that as far as transverse strengths are concerned, four are built to meet grade "A" requirements, eight will meet grade "B," two will fall in grade "C" and one falls in grade "N" (A = 3, B = 2, C = 1.33, N = Below).

Table II shows the cost of average customer tap where such amounts to anything over one secondary pole and service. According to most of the companies, however, very few farm lines have many of these types of taps. Most customers are reached by a service or, at most, a slack secondary span and service from transformer mounted on line pole. A certain number of these cannot be reached thus, and the information is included to show construction by various companies when such is used.

Most companies in the district seem to favor the conventional type transformer over the completely self-protecting type. However, there are three companies using the latter type, of which the author's company is one. Installed cost of either type is approximately the same. Over a five-year operating period the completely self-protecting type transformer has shown a very good record in our individual case. Over this period the average percentage failure of conventional transformers was 3.37 percent, as against 1.05 percent for the surge-

[*Continued on page* 53]

Table II—Rural Customer Tap and Service

Company	Location	Average Customer Tap					Transformer — Meter — Service							
		Length	Voltage	Pole Ht.	Cond. No.	Cost	Size Trans.	Type Trans.	Protection	Meter Size	Type	Pole or House	Including Sw. Box	Total Cost
Peoples Light Company	Davenport	600	Primary	30	6A	$172	3	Conv.	Arrester	15	3W	House	No	$147
Peoples Gas & Electric	Mason City	600	Primary	30	6A	163	1.5	Conv.	Arrester	15	3W	Pole	No	150
Kansas Electric Power	Leavenworth	600	Primary	30	4A1	158	3	C.S.P.	C.S.P.	5	3W	House	No	134
Iowa Electric Light & Power	Cedar Rapids	150	Sec.	30	6WP	33	3	Conv.	Air Gap	15	3W	House	No	110
Iowa–Nebraska Power	Lincoln	600	Primary	30	6 Cu.	148	1.5	Conv.	Arrester	15	3W	House	No	134
Iowa Public Service	Sioux City						3	Conv.	Arrester	15	3W	House	No	131
Iowa Public Service	Waterloo	225	Sec.	30	6WP	111	3	Conv.	Arrester	15	3W	Pole	Yes	143
Iowa City Light & Power	Iowa City	Most Customers Reached by Service					1.5	Conv.	Arrester	15	3W	House	No	111
Oklahoma Gas & Electric	Oklahoma City	Customer Furnishes Tap					(1.5) 3	Conv.	Air Gap	? 15	? 3W	House	No	110
St. Joseph Ry., Lt., Ht., & Pr.	St. Joseph.....	600	Primary	30	6 HDB	153	3	Conv.	Arrester	15	3W	Pole	Yes	160
Missouri Gas & Electric	Lexington	600	Primary	30	4A1	137	3	C.S.P.	C.S.P.	5	2W	Pole	No	112
Kansas Gas & Electric	Wichita	600	Primary	35	3–10 C.W.	131	3	Conv.	Arrester	15	3W	Pole	No	140
Nebraska Power Company	Omaha	600	Primary	30	Amer. 12	139	3	Conv.	Air Gap	10	3W	Pole	Yes	111
Kansas City Power & Light	Kansas City	465	Primary	35	4 ACSR	134	5	Conv.	Arrester	15	3W	?	Yes	183
Empire District Electric	Joplin	600	Primary	30	8 CW	146	3	C.S.P.	C.S.P.	15	3W	House	No	119

Notes — Dead end at each end. Pole at each end. One extra height pole. Two guys. Ground at each transformer. No poles included.

Street-Lighting Operating Experience in Pennsylvania

Nine companies with 175,000 street lamps report on patrolling, renewal schedules, use of isolating transformers, time switch control, trouble with lead wires, maintenance of glassware, painting and fault location

R. D. ZIMMERMAN,* Luzerne County Gas & Electric Corporation, Kingston, Pa.

NINE major utility companies have provided information regarding their practices in administering street-lighting systems. These companies have in all 169,377 series incandescent lamps, 3,217 multiple incandescents, eight sodium lamps (all on one company) and no mercury lamps. Seven of the companies have no remaining arc lamps; the three others have a total of 1,947 of them. Companies identified as C, D, E and I have larger street lighting systems than the others.

As was expected, because of the varying characteristics of the lighting systems and of the communities served there is considerable diversity in practice with regard to certain items of practice, but considerable uniformity on other points. The trends can best be deduced by noting the individual replies to the various queries raised. The same letter of the alphabet is used to identify the same company's reply to all the queries.

1. How often are street-lighting circuits patrolled for lamp outages?

A.—Not patrolled.
B.—No regular schedule.
C.—Every week except in towns where police report.
D.—At least once every week.
E.—Patrolman inspects as far as he can get each night.
F, G.—Every week.
H.—Nightly in city. Twice a week in outlying districts.
I.—Nightly in city. Weekly in small districts.

2. Are patrols made in daytime or at night?

C, F.—Daytime.
D, B, G.—Night.
H, I.—Night in cities. Day in outlying districts.

3. Are lamps replaced by patrolmen at time of patrolling?

A, B, G.—No.
C, E, F, H. I.—Yes.
D.—City, yes. Suburbs, no.

4. Are lamp renewals made after a lamp has reached its scheduled burning life?

A, B, E, G.—No.
C, F, H.—Yes.
D.—Cities, yes. Suburbs, no.
I.—No, except outlying districts.

5. Approximate burning hours before lamp is replaced?

D, E, G.—2,000 hours.
C.—2,000-2,100 hours.
F.—1,900 hours series; 900 hours multiple.
H.—1,700 hours.
I.—1,350 hours.

6. Number of lamp replacements per fixture per year?

A, C, G.—2.
B, E, I.—3.
D.—2 to 2½.
F.—2 to 3.
H.—2.35.

7. Percentage of lamps equipped with insulating transformers (either individual or group)?

A.—0.6 percent.
B.—7.5 percent.
C.—12 percent.
D.—1.5 percent (suburbs, city none).
E.—11.
F.—2.
G.—55.
H.—9.
I.—4.2.

8. Are insulating transformers used on steel poles or standards?

A, D, F.—No.
B, C, B, GHI.—Yes.

9. For what range of lamp sizes are insulating transformers used?

A.—Up to and including 400 cp.
B, C, E.—600 cp. and above.
D.—Do not use in cities.
F.—400 cp.
G.—Over 100 cp.
H, I.—400 cp. and above.

10. Are (either the individual or group) transformers used primarily for safety, appearance or better operating performance?

A, B, D, F, G.—Safety.
C.—Safety and appearance.
E, H, I.—Safety and better operating performance.

11. Percentages of lights controlled in various ways.

Company	Time Switch	Photo Cell	Operator	Resonant
A	70	30	0	0
B	60	5	29	0
C	52.5	0	47.5	0
D	95	2.5	2.5	0
E	18	0	82	0
F	99	0	1	0
G	78	2	20	0
H	60	0	40	0
I	35	0	65	0

12. Frequency of inspection of primary voltage control devices.

A.—Annually.
B, C, I.—No definite schedule.
D.—Every two weeks.
E.—Semi-annually.
F.—Every two years.
G.—Weekly.
H.—No inspection.

13. What does the inspection of control device comprise?

A.—General.
C.—Checking type and condition of oil.
D.—Checking time, cleaning brushes and commutation on motor, adjusting operating parts and checking oil.
E.—Check oil level and condition; current checked once each year.
F.—Equipment moved to shop for general overhauling.

14. What protective devices are used at the source?

A, B, I.—Fuses and arrester.
C, F, G.—Arresters.
D.—Arresters and fused cutouts.
E.—G. E. Co. protective device.
H.—Fuses and disconnect switch

15. Has performance of protective devices been satisfactory?

A, B, C, D, E, F, G, H.—Yes.
I.—Not entirely.

* Adapted from a report to the transmission and distribution committee of the Pennsylvania Electric Association.

16. How does use of photocell compare with time switch in number of hours burning.

A.—140 hours less per year than time switch.
B, D, G.—No record.
C, E, F, H, F.—None used.

17. If cutouts are used on loops from main lines, have they performed satisfactorily?

G.—Yes.
I.—Yes; one type not satisfactory; insufficient information on others.
A, B, C, D, E, F, H.—None used.

18. Have you experienced conductor crystallization?

A, C, D, E, F, G, I.—No.
B, H.—Yes.

19. Have you experienced any trouble with lead wire breaking at fixture?

A.—Yes, screws loosen and wire burns off.
B, C, E, G, H, I.—Yes.
D.—Yes, but rigidly hung lamps and duplex conductor eliminates much of trouble.

20. How was trouble with breaking lead wires eliminated?

A.—Attach fixture rigidly to supporting bracket.
B, D, E, G, H.—Flexible cable used.
C.—Extra flexible wire used.
I.—Spiraled the lead for four or five turns about a 1-in. mandrel.

21. How often is glassware cleaned?

A, G.—Every three months.
B, D.—No schedule.
C.—At least once per month.
E.—Once every month.
F, I.—Semi-annually.
H.—Every two or four months.

22. Do you use a cleaning compound for glassware?

A, B, G, I.—No.
C, D, E, H.—Yes.

23. Is it necessary to use special protection for hands or eyes when cleaning glassware with cleaning compound?

C.—Rubber gloves in winter.
D.—Yes.
E.—No.
H.—Rubber gloves.

24. Are graphic records kept of street lighting circuits at substation or at constant-current transformers?

A, B, C, D, F, H, I.—No.
E.—Yes, on circuits out of substations. No, on constant-current pole-type regulators.
G.—Yes at both substation and transformer station.

25. Are wood poles for street lighting circuits painted?

A, B, C, D, E, H.—No.
F.—Not generally.
G.—Yes.
I.—Some.

26. Are fixtures painted in place for better appearance?

A, B, C, D, G, I.—Yes.
E.—Only when in shop for repairs.
F, H.—No.

27. How are open circuits located?

Company
A—One leg grounded and circuit patrolled and tested with neon pencil.
B—Shorting out sections until located.
C—Grounding both legs and ringing out with magneto.
D—Grounding at transformer and testing at lamp units.
E—110 volts applied and test lamp used.
F—Cut and try secondary voltage.
G—110 volts applied and test lamp used.
H—550 volts d.c. test current.
I—440 volts test set or 115 volts a.c. with test lamp or magneto.

Cost Considerations in Rural Line Design

[*Continued from page* 51]

proof type. Practically all of these failures on the latter type have been on the old type. This is based on an average of 531 units in service over that period. A total of approximately 1,000 units are now in service.

Most reporting companies use arresters for protection of conventional type transformers. None reported the use of expulsion type gaps now being put on the market.

Table III shows a summation of costs leading to an investment cost per mile and per customer. This is made up on the basis of bare minimum costs, including only line, transformer, meter and service without primary or secondary taps.

These costs are on the basis of one transformer per customer and seem to be typical of practice over this territory. It can be proved that individual transformers can be set cheaper than to build two spans of long span secondary when all guys, anchors, conductor, etc., are taken into consideration. Also, transformers may be moved or salvaged, when service is discontinued, at a high salvage value. Experiences indicate that in case of secondary, the cost of removal will at least equal the salvage value of the material removed. Also shown is the investment allowance which the various companies make per customer. These represent, in cost cases, the amounts filed with the various state commissions.

These data include only the cost of the line itself. They do not include any added investment for generation, transmission, substation or protective switching equipment.

Table III—Investment Cost and Allowance Per Customer

Company	Location	Prim. Cost Per Mile	Transformer Meter & Serv.	No. Cust. Per Mile	Inv. Cost Per Mile	Inv. Cost Per Cust.	Maximum Allowance Per Customer
Peoples Light Company	Davenport	649	147	3.0	1,090	363	Min. monthly bill must be 2 per cent of cost for 50 mos.
Peoples Gas & Electric	Mason City	724	150	2.0	1,024	512	No fixed amount
Kansas Electric Power	Leavenworth	619	134	3.0	1,021	340	Monthly bill must be 2 per cent of cost with $500 max.
Iowa Electric Light & Power	Cedar Rapids	613	110	2.25	860	382	$160
Iowa-Nebraska Power	Lincoln	728	134	2.33	1,040	447	$450
Iowa Public Service	Sioux City	793	131	2.5	1,120	448	Six times annual revenue
Iowa Public Service	Waterloo	802	143	3.26	1,268	389	$500
Iowa City Light & Power	Iowa City	720	111	3.0	1,053	351	Min. monthly bill must be 2 per cent of total cost
Oklahoma Gas & Electric	Oklahoma City	578	110	3.62	976	270	½ mile main line plus transf. meter service
St. Joseph Ry., Lt., Ht. & Pwr.	St. Joseph	651	160	6.0	1,611	252	$210 — 15 per cent rental on excess
Missouri Gas & Electric	Lexington	578	112	3.5	1,131	323	$250 max.— 10 per cent net yearly return required
Kansas Gas & Electric	Wichita	521	140	3.68	1,036	281	No set maximum
Nebraska Power Company	Omaha	532	111	2.5	809	323	Two contracts per mile
Kansas City Power & Light	Kansas City	555	183	2.56	1,023	400	$300
Empire District Electric	Joplin	621	119	3.59	1,048	291	2½ times annual revenue

Water Heater Service on Flat Rate Base

Company-controlled off-peak flat rate element and customer-controlled booster utilized at Toronto — Flat rate yields $2.67 per month on estimated investment of $13.40

C. E. SCHWENGER and A. W. J. Stewart,† Toronto Hydro-Electric System, Toronto, Canada*

IN THE past seven years Toronto Hydro has added to its lines more than 20,000 electric water heaters designed to operate basically on a flat rate charge of 49 cents per 100 watts of rating per month. This results in a flat rate net revenue of $2.67 per month for the average heater. The investment in the company-owned heater and necessary distribution plant is estimated at $13.40 per heater. Heaters are subject to off-peak control and many tanks are equipped with a customer-controlled booster of 2,000–3,000 watts capacity.

Hydro Owns Heaters

The number of flat rate electric water heaters in service on the distribution lines of the Toronto Hydro-Electric System is 20,760. These were installed during the past seven years and have a total connected load of 12,765 kw. or an average of 605 watts per flat rate heater. These installations are of the storage type and, as just indicated, are of the low-wattage type. These are all the property of the Toronto Hydro-Electric System. The low-wattage type was chosen in preference to a high-wattage type because of the smaller size tanks and consequent lower capital cost involved, also smaller space required on consumer's premises. Furthermore, more consumers can be served from the existing lines before requiring reinforcement to maintain good voltage. The remote control of the flat rate heaters can be accomplished by the use of equipment of lower current carrying capacity and consequent saving in cost than with higher current.

49 Cents per 100 Watts

The flat rate charge to the consumer for the water heating service is 49 cents per 100 watts rated capacity of flat rate heater per month, to which is applied a 10 percent discount for prompt payment. Included in this rate is the charge for electrical energy consumed, as well as all carrying charges on the complete water heater installation and maintenance and operating charges on same. The main feature of such a charge is that the consumer knows each month, for his particular water heater installation, exactly how much his monthly bill is going to be. All flat rate water heater installations include completely insulated galvanized iron storage tank (Fig. 1) with heating elements and control devices completely wired up. No charge is made to the consumer for the installation of flat rate water heater equipment on his premises, except that if any additional work is required involving consumer's plumb-

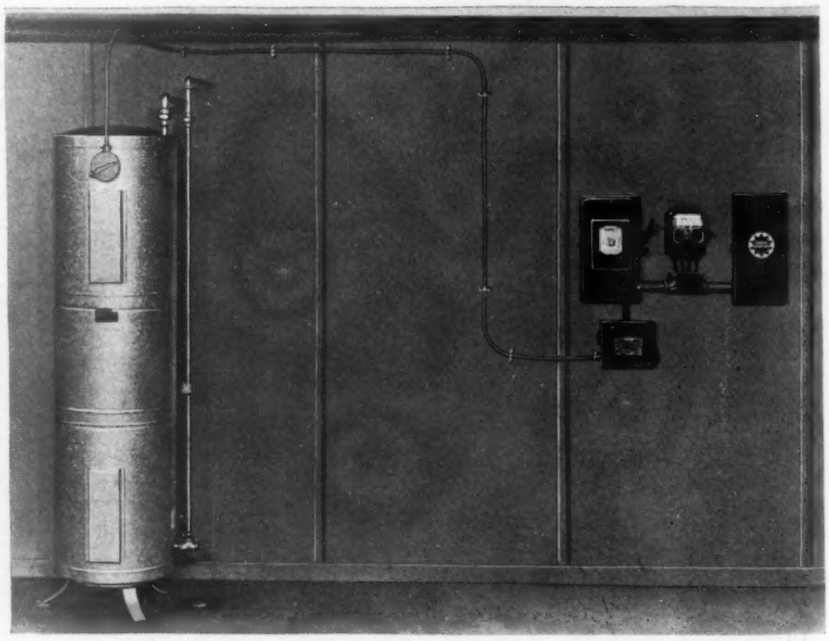


FIG. 1—Flat rate water heater installations are company-owned and are provided and installed without charge

*Engineer of distribution. †Manager appliance department.

ing or wiring it is at the consumer's expense.

The flat rate heater derives its name from the method of charging for the service, which as above stated is on the basis of 49 cents per 100 watts rating of the flat rate heater element. Current supplied to these heat-

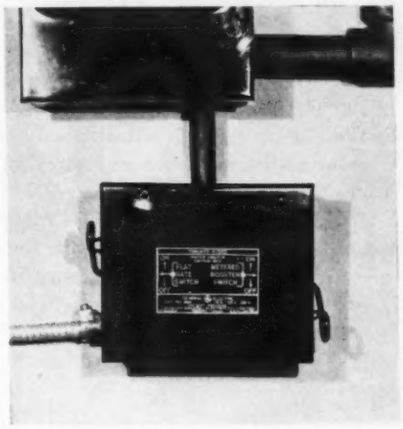


FIG. 2—Flat rate service, subject to control by utility system at peak periods, passes through box to heater. Booster element is controlled at box by customer

ers does not pass through the consumer's meter, but is obtained directly from the street mains through separate service wire and separate wire in consumer's standpipe. This separate conductor is installed at the system's expense and is included in the complete water heater installation.

The electric supply to these water heaters is subject to off-peak control and may, therefore, be interrupted by the system during its peak-load hours. The average period of such interruption is on the order of one hour. These interruptions do not occur every day and take place only at such times as when a heavy system peak load takes place. The peak-load control system used is the pilot wire and relay system, which will be described later.

Sizes and Capacities

The galvanized iron tanks for flat rate water heater installations are approximately 58 in. in height, standardized as follows:

Tank No.	Tank Sizes Capacity Imperial Gal.	Tank Diam., In.	Heater Size Watts
40	30	14	400 to 900
52	40	16	1000 to 1250
66	51	51	1250 to 1500
82	63	20	1500 to 2000
100	77	22	2000 to 3000

Where greater capacities of hot water supply are required for commercial services, such as in restaurants, multiples of the larger units are installed. As many as five larger units have so far been installed on one service.

The flat rate electric heating elements are standardized in 100-watt increments for installations from 400 watts to 1,000 watts, inclusive, and the larger heaters are standardized, 1,250, 1,500, 2,000, 2,500 and 3,000 watts. All tanks are insulated with 2 in. of mineral wool held in place against the tank by means of a galvanized iron cover. All tanks are equipped with a strap-on thermostat located approximately 12 in. from the bottom of the tank to control the flat rate water heater.

Booster Element

Many domestic installations have, in addition to the flat rate water heater, a high-wattage (2,000 or 3,000 watts) heating element, installed near the top of the tank, approximately 10 in. from the dome, and receiving its energy from the regular metered service of the consumer. This heater, which is known as the "Booster Heater," is intended for use as a means of supplying hot water quickly in case the flat rate water heater supply has become exhausted. It is also controlled by a thermostat, strapped on the tank approximately 8 in. from the top.

It might be mentioned here that each thermostat is equipped with a heat fuse as an added protection to the equipment. The supply to both the flat rate heating element and the booster element is controlled by a switch box similar to that in Fig. 2. These switches are so arranged that at no time can the booster element be connected in service without the flat rate switch being closed (Fig. 3), in order to eliminate the possibility of a consumer cutting off the flat rate heater supply for an extended period, and on his return making the mistake of throwing in the booster switch instead of the flat rate switch.

Many consumers operate their water heater installations with both the booster element and the flat rate element in service at all times, while others operate with flat rate heater element only in service normally and booster heater used only on occasions when an additional supply of hot water is required.

Since the service for flat rate heaters is run separately from street mains to each flat rate heater, an additional wire to the consumer's regular service wires is required. In the majority of cases an additional No. 10 B. & S. conductor is drawn into the consumer's standpipe and to this is connected an additional No. 8 service wire run in from pole to standpipe. In some cases where the standpipe is of insufficient capacity to allow the drawing in of the additional wire an armored conductor installed externally to the consumer's standpipe is used, same being installed beside and behind the consumer's standpipe and carried into the house to the water heater switch.

Pilot Wire, Relay Control

Each flat rate service installed from overhead pole line to consumer's standpipe is connected to the street mains through a high impedance relay which is operated by a pilot wire at 120 volts, receiving its energy from the nearest substation. The relay is of the normally closed type and when energized from the pilot wire opens the flat rate heater circuit. Thus the pilot wire is energized during the period that the flat rate heater current is interrupted and flat rate heater service is restored when the pilot wire is de-energized.

The relay used is of the outdoor type and is mounted on the poles of the system and each controls the several flat rate heater services from the pole on which it is installed.

On account of the large number of water heaters to be controlled and consequently the large number of relays required it was necessary, in order to keep the size of the control conductors small, to obtain a relay requiring small control current to operate and also to operate over a wide range of voltage. The relay used must meet the following requirements:

Relay Requirements

It must stand 100,000 operations at 35 amp. full load on contacts at 120 volts, 25 cycles. It must draw less than 50 milliamperes control current and must operate at a voltage on control circuit as low as 70, at 25 cycles. Several such relays are available.

The practice in Toronto was initially to limit the number of relays

per control circuit to 500, which would give a normal loading of approximately 25 amp. Actual relays now received operate on much lower currents than the original requirement of 50 milliamperes and it is now possible to operate from 700 to 900 relays per circuit without exceeding 25 amps.

Network on Control

On account of the small current per circuit required, it was decided to use as control conductor a No. 10 Copperweld weatherproof conductor, 40 percent conductivity, as being most economical. These circuits are strung throughout the control areas as a network, the position of the wires being as near as possible to the system's common neutral, which forms the return circuit for all control current. The common neutral conductors also form a network. This location for the control circuit allows the minimum of exposure to lightning surges, with consequent safety to the relay coils, which are of very high impedance. Incidentally each relay coil is given a dielectric test of 1,500 volts to ground. As an added protection against lightning the policy of installing a low-voltage lightning arrester gap every 1,000 ft. on the network has been followed.

In the selection of the relay a choice had to be made between the relays operating normally closed or normally opened by control current. The relay which opened by control current was finally chosen because of the fact that any relay not functioning properly would not remain open upon being deenergized and consequently cause the water heater to receive no current, causing consumers to complain through lack of hot water. This system, therefore, with no control current normally in the control circuits, allows all water heaters to be connected to the lines through spring action on the contacts in the relays. When it is desired to disconnect the water heaters the relays are energized and the circuit to the water heaters is opened and kept open as long as the control current energizes the coils.

Substation Equipment

There are seven substations having water heater control equipment. The district served by each substation is divided into several areas, each controlled by one control circuit, the maximum number of control circuits for any substation being six.

In the substation on the control board for the control circuits instruments are installed for the measurement of control current in each circuit. This is necessary in order to make sure that all relays are connected to the control circuit. This is done by the simple addition of the currents required by all the relays on each circuit. If a drop in control current from day to day is detected,

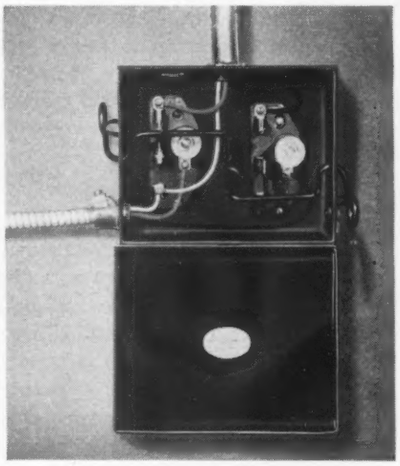


FIG. 3—Booster element control switch at right is interlocked so flat rate switch will always be closed when booster switch is closed

it is evident that the relays are not all connected to the circuit and are, therefore, not functioning. The board is also equipped with a special interrupter or cycling device which can operate the relays so that they are interrupted for five seconds every minute. An inspection in the field would indicate the relays which are not clicking in and out on this timing. Another device which is installed on this board is a relay which gives a signal in the substation should an accidental contact be made with the control circuit by other foreign circuits, thus energizing them. Such an accidental contact would, of course, disconnect all water heaters. Other equipment is also located on the board to show on which control circuit this contact is made.

The control board is supplied with energy for the control circuits from the lighting system in the substation at 120 volts, 25 cycles, to ground. The over-all cost per heater controlled, which includes the cost of control board in substation, No. 10 copper-clad control wire network, control relays on the poles and water heater services to the buildings, at the present time is approximately $13.50 per heater. This figure will be materially decreased as the number of water heaters increases, on account of the fact that as many as seven heaters may be connected to any one relay and at the present time there is an average of only approximately two heaters per relay. Thus many water heater installations may be connected to the system in the controlled areas without additional expense for relays or control wire.

To date the control system has functioned very satisfactorily with few operating difficulties. It is used regularly to reduce the load on distribution equipment during peak-load hours, thereby effecting a saving in capital cost of distribution equipment otherwise required, and at the same time reducing the amount of purchase power, which is bought on a peak-load basis.

Requirements Modified in New N.E.S. Code

[*Continued from page* 46]

sidered obvious when taking into account "voltage" as defined in the code.

One of the important changes with regard to insulators used on supply lines consists of the inclusion in the revised code of several alternative methods of providing insulation for transmission lines at crossings over communication lines and railroad tracks. These methods have been prescribed in accordance with modern engineering and good practice. The revised requirements have been clarified in such a way that they can now be interpreted more easily than were the corresponding provisions in the present code.

The requirements for underground line construction have been materially revised, although a great deal of the present material has been retained. The most important revision in this section of the code was the inclusion of rules governing the installation of buried cable and specifying the conditions under which electric supply and communication cables should be installed underground when not in conduit, but when in close proximity to each other.

Finishes Designed for Infra-Red

Complete line of finishes available designed specifically for infra-red applications — Where to use infra-red — Highly polished surfaces less absorptive to rays

DAVID DONOVAN, Ault & Wiborg Corporation, New York, N. Y.

IT IS ONLY within the last year that the use of infra-red baking for industrial finishing operations has become widespread, even though it has been used in a more limited manner for a considerably longer period. Infra-red has not only provided a substitute for the gas-fired convection ovens, which have hitherto been more or less standard equipment, but has also made it practical to bake out finishes where air-dry lacquers were previously used. With the influence of the National Defense program and a general demand for faster production methods, infra-red finishing is taking on new importance since it offers definite opportunities to speed up schedules in many industries.

Perhaps the single greatest advantage of infra-red baking is the speed schedules it makes possible. Over air-dry materials the difference of course in tremendous. But even where baking enamels had been previously used with convection ovens infra-red has made possible some surprising savings in time. Here are some typical schedules for infra-red on various types of metal products:

Filing Cabinets—Baking time, six minutes. Hourly production rate, 2,250 lb. of steel. Temperature required, 300 deg. F. Current consumption, 36 kw. hourly.

Phonograph Record Changers—Baking time, ten minutes. Hourly production rate, 1,000 lb. of steel. Temperature required, 350 deg. F. Current consumption, 42 kw. hourly.

Washing Machines—Baking time, seven minutes. Hourly production rate, 1,000 lb. of steel. Temperature required, 325 deg. F. Current consumption, 103 kw. hourly.

Water Heaters—Baking time, eight minutes. Hourly production rate, 1,000 lb. of steel. Temperature required, 300 deg. F. Current consumption, 38 kw. hourly.

Schedules for different objects vary, of course, with the size and shape of the object and the construction and size of the infra-red tunnel or lamp set-up (see ELECTRICAL WORLD, April 5, 1941).

Infra-red (or, to be technical, "near" infra-red) rays bake merely because they are converted into heat when they strike most objects. Infra-red heat makes industrial finishes by radiation, while hot air in baking ovens bakes finishes by convection, but the heat deposited actually cures the paint film.

Infra-red rays will pass through air without heating the air to any appreciable extent. On the other hand, these rays are stopped by a very thin layer of water, while other materials, such as gold or highly polished brass or silver, will reflect almost all of the rays and will not absorb or transmit them. Because of this it has been found that it is not as practical to use infra-red heat for baking a clear finish on shiny brass objects or on similar highly polished surfaces which tend to reflect, rather than absorb, the infra-red rays as it is on more absorptive surfaces. It is interesting to note that black creates an acceleration of drying, rather than a retardation. Black tends to absorb more of infra-red radiation than do any other colors and thus tends to bake more quickly.

When to Use Infra-Red

Generally speaking, most anything that can be baked in a hot-air oven can be baked in an infra-red oven. But there are certain technical limitations which the user of this method should take into account in order to achieve the maximum benefits which this speed-baking method can provide:

1. Generally speaking, hidden surfaces are hard to bake out, particularly if the product is not metal. Care should be taken in the design of the infra-red lamp bank and in the operation of the conveyor line to provide for direct contact with the infra-red rays on as many surfaces as is possible.

2. Colors and surface effects affect infra-red drying times. Dark colors bake faster than light ones; polished surfaces and aluminum, particularly if finished with a clear material, are harder to bake out than unpolished surfaces. Therefore, whenever possible, schedules must be adjusted to take these discrepancies into account.

3. Heavy-gage metal requires a longer baking time or a higher heat than thin sheets. If possible, it is best to run parts of varying gage through the rays at different times, but in any event, any great disparity of metal thickness should be taken into account in fixing the baking schedule.

4. Contrary to early beliefs, the size and shape of the object need not be limiting factors in infra-red baking. Most of the baking has been done on metal, although good results have been obtained recently with finished plastic products, wood and other materials.

In almost all cases a conveyor-type oven is advisable for use in infra-red baking. On a conveyor chain the objects to be baked pass through one zone of spottiness to another in passing by the lamps which are spot sources of energy, so that in a length of 8 to 12 ft. the entire surface of the object receives about the same amount of heat.

Infra-Red Finishes Available

Practically all types of baked enamel finishes are now available for infra-red operations. It is possible to finish articles by infra-red methods with smooth finishes, wrinkles, hammered effects and grains. When infra-red heat sources were first introduced they were used with the then existing baked enamel finishes. It was found that some of these worked well with infra-red, such as Polymerin, a high-speed finish already used with gas ovens. Other finishes did not seem well suited to infra-red, particularly in certain applications.

Finish manufacturers have since produced a number of formulations designed specifically for use with infra-red. Today a complete line of infra-red finishes is available, including primers, surfacers and finishing coats. Obviously the quality of the finish used by a manufacturer depends on the product. The maker of toy automobiles, for example, requires a much less expensive finish than the washing machine manufacturer. But the variety of infra-red finishes is now extensive and the scope of infra-red finishing seems destined to continue its expansion.

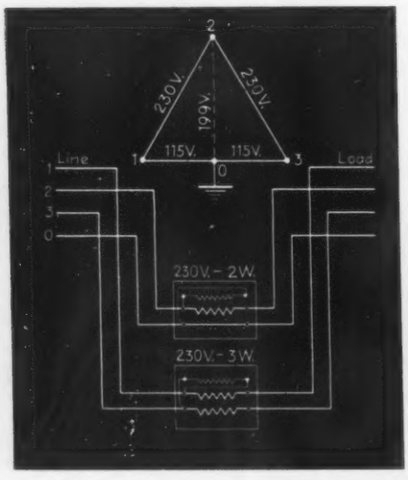
Metering 4-Wire, 3-Phase Delta Services—II

Summary of eight methods used in practice—consideration of voltage unbalance, measurement of reactive and combined metering

RALPH A. POWERS, Boston Edison Company*

IN ELECTRICAL WORLD (August 23, page 50) was presented a résumé of eight modern methods of metering four-wire, three-phase, delta services, based on a survey of the practice of a number of electric utility companies in different parts of the country. In this concluding section of the article a summary is given of the advantages and disadvantages of these methods, with cost data applying to meters and instrument transformers where required. In the first three methods the meters are self-contained, and in the last five instrument transformers are necessary.

*From a paper before the New England Association of Meter Engineers.

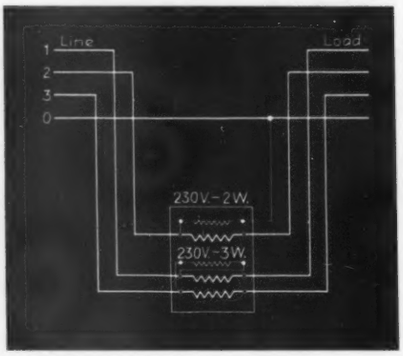


Method I—Two single-phase meters

1. Most economical initial cost and maintenance.
2. Does not permit combined demand.
3. Requires two meters for a single class of service.
4. Possible error under certain conditions of unbalance.

Meter cost, $13.50 (50 amp.). Total, $27 for two.

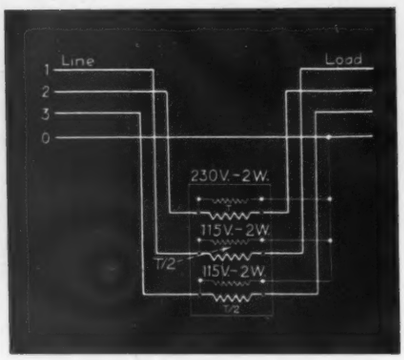
It is apparent that the deciding factor in the selection of the proper meter (two-element vs. three-element) is the possible error in registration due to certain conditions of voltage and current unbalance in the three-wire lighting circuit. On small loads, where self-contained meters are used, the error may be of little importance and without justification of the more expensive three-element meter. On large installations, requiring current transformers, it may occasionally be desirable to use the three-element meter. One company reports that the latter was required in about 1 percent of the cases.



Method II—Two-element delta meter

1. Registration and demand in single meter.
2. Same test procedure as with three-wire, three-phase standard meter.
3. Possible error under certain conditions of unbalance.

Meter cost, $33.50 (50 amp.).

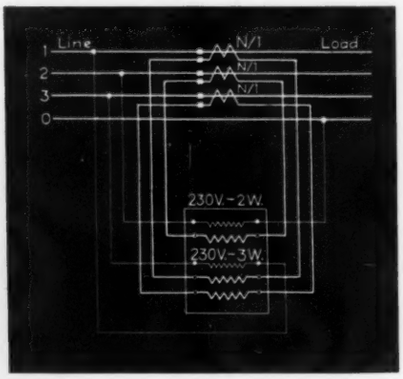


Method III—Three-element delta meter

1. Correct under all conditions of voltage.
2. Increased meter capacity in lighting phases.
3. Requires special testing procedure.

Meter cost, $55 (50 amp.).

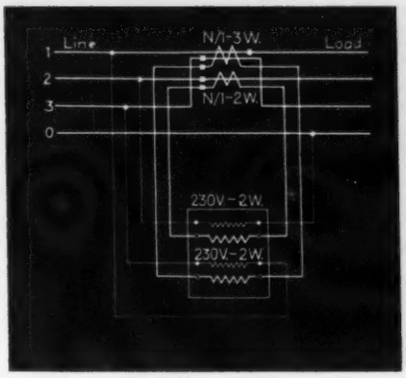
On some rates it is necessary to measure either reactive kva. or kva demand. This is accomplished with delta meters, as with other types, by phasing transformers having properly selected taps. For the reactive



Method IV—Two-element delta meter with current transformers

1. Same test procedure as with three-wire, three-phase standard meter.
2. Possible error under certain conditions of unbalance.
3. With older type current transformers, relative magnitude of lighting and power loads important. Modern current transformers offer a solution.

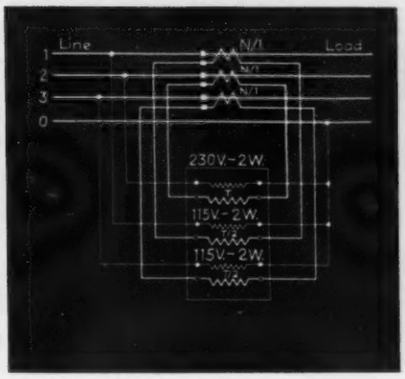
Meter cost, $24.50. Transformer cost, $59. Total, $83.50.



Method V—Two-element, 230-volt, three-wire, three-phase meter with a two-wire and a three-wire C.T.

1. Permits use of standard three-wire, three-phase meter.
2. Permits use of any existing stock of three-wire transformers.
3. Slightly more economical than Method IV.
4. Possible error under certain conditions of unbalance.
5. Three-wire current transformer inferior in accuracy, insulation and overload capacity.

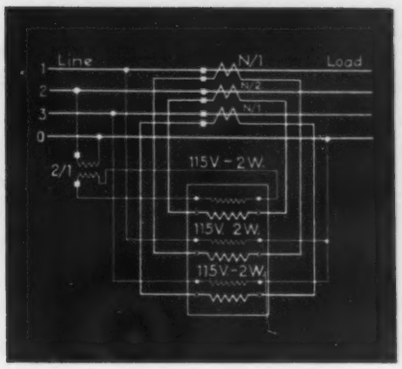
Meter cost, $23. Transformer cost, $50. Total, $73.



Method VI—Three-element delta meter with current transformers

1. Correct under all conditions of unbalance.
2. Requires special testing procedure.
3. With older type current transformers, may over-meter power phase. Modern current transformers offer a solution.

Meter cost, $44.50. Transformer cost, $59. Total, $103.50.



Method VII—Three-element wye meter with current transformers and a 2:1 potential transformer

1. Permits use of standard three-element wye meter.
2. Permits use of higher capacity current transformers in lighting phases.
3. Correct under all conditions of unbalance.
4. Requires use of additional potential transformer.

Meter cost, $37. C.T., $59. P.T., $28. Total, $124.

Method VIII—Same as Method VII except 2:1 P.T. omitted

1. Permits use of standard three-element wye meter.
2. Correct under all conditions of unbalance.
3. Lower initial cost than Method VII.
4. 200 volts impressed on 115-volt coil. Special test procedure.

Meter cost, $37. Transformer cost, $59. Total, $96.

kva. delta meter it is possible to use the same phasing transformer as is used with the standard three-wire, three-phase meter by reconnecting the coils. This method is shown in an accompanying illustration with a two-element meter (four-wire, three-phase delta watt-hour) and a reactive kva. meter and phasing transformer.

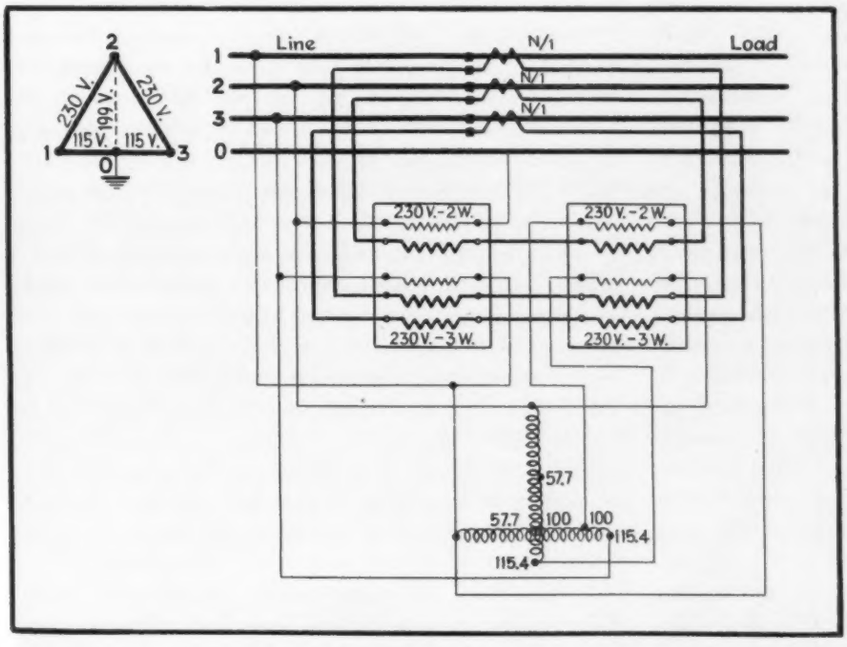
Thus far the metering of combined light and power loads from a four-wire delta service has been considered. In case two individual services cannot be combined into a single four-wire service and metered as previously described, it is advisable to meter the two services individually with present standard methods.

If combined demand is required it may be obtained by using contact-operated totalizing demand meters. In this connection, where a three-wire, three-phase power service and a three-wire lighting service exist and are now separately metered, further consideration should be given to the metering for the three-phase power service.

Often when existing services are changed over to the four-wire delta method slightly different problems arise. When supplied from grounded Y-delta, single-phase transformers, and metered from the standard two-element, three-phase, three-wire meter, it will be possible to take unmetered current from the unmetered phase to ground. The possibility of this in cases of larger customers may be somewhat remote, but there would be less likelihood of energy diversion if the unmetered leg were the one having 200 volts to ground. When, therefore, it is uneconomical to install a delta meter, it may be advisable to at least determine if the metered phases are 115 volts to ground, and if not, to change these connections.

In order to install a delta meter

[*Continued on page* 118]



Measurement of energy and reactive volt-ampere-hours in a three-phase, four-wire delta circuit using two two-element delta meters. Each meter has one two-wire and one three-wire element of the same current rating

Editorials

S. B. WILLIAMS, *Editor*

Flywheel or Flytrap

THE ADDRESS of Federal Power Commissioner Manly before the recent convention of the National Association of Railroad and Utilities Commissioners deserves careful reading by every public utility executive. It is a clear-cut and timely statement of the direction rate regulation should take during the period of the emergency.

Two problems are considered, one the amortization of plant used for defense and the other the policy with respect to rate adjustments because of higher revenues during the emergency period.

Commissioner Manly disposes of the second problem by stating that larger revenues during a brief period were no justification for rate reductions when a serious decline might be expected after the emergency. Likewise, he saw no justification in making basic rate increases to take care of temporarily higher costs.

That is fairly stated, and assuming the ability of government to check inflation trends, it should bring no hardship to most companies. Where there is little or no defense load or where local industries have been severely hurt by priorities, it would seem unfair not to permit some kind of relief to a utility that has to meet greatly increasing costs.

What to do with emergency plant investment is something else. Commissioner Manly's suggestion appears simple and generous. But is it? Reflection on FPC policy in this direction causes one to remember the old adage: "Beware of Greeks bearing gifts."

Plant investment used only during the emergency, he recommends, should be amortized during that period. One cannot quarrel very much with that provided one knows how long the emergency will last or has a contract that requires the customer to carry the investment.

A great part of the new investment, however, the Commissioner contends, and rightly so, will have a useful life far beyond the emergency, and in that event he states the problem is "essentially one of depreciation." Since plant will be used harder and longer hours the more should be put into depreciation reserve.

If this emergency is to be followed by another depression a larger depreciation reserve than is actually needed might be very helpful. It might also help during the next four years to finance the plant commitments already made. Furthermore, larger amounts paid into depreciation would have the effect of holding net down to a point where customers and labor were not dissatisfied with their lot.

In other words, the suggestion has many elements of merit were it not for the fact that depreciation account in the mind of FPC is something by which original cost is reduced to arrive at the rate base. Should this, the prudent investment theory, be invoked after the emergency, and especially if the demand does not warrant new investment, the earning power of utilities will be greatly reduced.

There is no question but what in some cases depreciation account has in the past given way to dividends. This suggestion of Commissioner Manly offers a quick and painless means of rectifying that condition. To others it offers an excellent means of evading the embarrassment of temporarily higher earnings.

If this is a true flywheel that the commissioner is suggesting and not a flytrap, it will go a long way toward stabilizing utility operations.

Distribution Transformer Loading Studies

DESPITE all the study that has been given to devising methods of ascertaining the degree of distribution transformer loading, the matter has by no means been settled. No further proof of this is needed than the E.E.I. report just published from which it appears that practices are only slowly converging to any single method of load determination. Meter methods are moderately costly, but so are methods which analyze the customer consumption records in the office. While the ideal is still a transformer which would read, record or signal the time and amount of its own state of loading, few utilities seem to be willing to rely solely on such indicators as are available.

Although repetitive excessive overloading is known to shorten insulation life to a fairly definite degree, and frequent overloading is also bad from the voltage regulation standpoint, little of this surveying is aimed primarily at sizable curtailment of overload burnouts, because relatively few distribution transformers have been lost in this way. The aim is more a matter of long-term economics.

Consistent underloading is a waste of capital and a waste of capacity that is serious in a period when money is needed for so many things and equipment deliveries deferred. With distribution transformers often constituting nearly one-sixth of utility system investment, every one percent that average transformer loading can safely be boosted saves an appreciable part of the total system capacity investment, an accumulation of which would buy capacitors or regulators or wire to more than offset the added transformer drop and better the service along the whole feeder.

With about one dollar in every six devoted to transformers, the electric utilities can well afford to keep insistently at the task of applying measuring instruments, trying out indicators and analyzing loading records until a clear-cut and universal answer is found.

Power Salesmen and Subcontractors

TWO MONTHS AGO we suggested that power salesmen might bird-dog subcontractors for OPM. It seemed to be such a natural that the least we thought OPM would do would be to call one or two utility people to Washington to see if there really was anything to the idea, especially so since OPM was talking itself blue in the face demanding work spread. Nothing was done and the excuse was that the Army and Navy didn't spread work and the big contractors didn't subcontract.

That's something the power salesmen can't do a thing about. Until OPM's Defense Contract Service (DCS) can untangle that snarl there seems little sense in locating a large number of potential subcontractors. When the time is right—and perhaps now the time is right; see "Washington Comment" on page 62—the utilities have everything to gain by helping the local DCS offices. There are thirty-six such offices, each headed by a business man in the capacity of coordinator. Against the time when the subcontractors will be needed it might be well for utility power sales managers to get acquainted with their local coordinators.

Almost any day utilities may find that priorities are causing some good industrial customers to close the doors. These customers and their employees ought to be very appreciative in the future of any help at this time.

Implication of Prudent Investment Depreciation Theory

IS DEPRECIATION the gradual retirement of property and therefore amortization of equity, or is it a fund to replace equipment as it wears out and thereby maintain the equity interest? Some of this property will wear out progressively and some will lose value in an instant, such as loss from storm or accident. In these latter instances a reserve in excess of actual loss in value is set up to meet such losses as they do occur. Obviously, if the customer pays a rate that is greater than the rate of obsolescence plus insurance against depreciation that does not act progressively with time, he has a stake in the depreciation reserve. But if we assume, as we must, that accrued and actual depreciation are approximately the same, it is hard to see how the customer has contributed to anything but the replacement of the property he has been using.

On the other hand, if the money he pays is kept in a reserve until physical retirement or replacement actually takes place, this reserve should draw interest and this interest should be credited to the reserve and act either to reduce the customer's payments or shorten the time.

If the prudent investment theory, as laid down by the Federal Power Commission in the recent State Line case, were invoked there could be no stability to rates because the base would go down each year as the reserve builds up, and then upon replacement the base would bound back up. The only way a utility could protect itself from severe losses under such a doctrine would be to replace all property each year. That, of course, would be silly as well as impractical.

Luxuries

READING THE BRIEFS of George A. Hughes, Hotpoint chairman, protesting to the Senate finance committee that the proposed taxes discriminate against electric ranges and electric storage water heaters brought up the thought that in the minds of a great many people electricity is still a luxury.

The bill would tax all electric appliances, but not the non-electric counterparts of these devices. It is doubtful if the drafters of the bill realized the discriminations they were setting up. It is much more likely that they merely saw in electrical appliances a luxury item that could and should be taxed. Somehow or other the devices using other forms of fuel, such as gas, or oil or coal, do not seem to have that "it" of electrical appliances and so they are not thought of as luxury items.

Also, the promotion of electrical appliances has been on the side of easier living, and perhaps that in the public mind has put them in the luxury class. Twenty-five or thirty years ago they may have been luxuries. But American living is progressive and what was a luxury yesterday is frequently a necessity tomorrow.

Luxury always carries with it a little bit of the thought of extravagance, of costing more. The real luxury of electrical appliances is in the better living they bring. They save food and health, they do jobs quicker and better, they eliminate drudgery and dirt and, if anything, they cost less to operate.

Dignity in a Smaller Home

WE SALUTE our English contemporary, *Electrical Review,* which with its first issue in August went to a bantam size on account of the exigencies of war time publication.

Electrical Review has been typical of English technical publications in its resistance to change. Not only did it maintain the time-accepted size, but its format was the same. The reduced size has naturally brought some changes in format.

One gets the impression that while necessity caused a shrinkage of dimension, it did not otherwise alter the appearance of content. In fact, the announcement states that "the total amount of editorial matter has not been reduced; the reduction is in the size of the advertisements."

When we looked through this first smaller size issue we felt it represented something fine, something strong and firm. This seventy-year-old publication, the world's oldest electrical publication, while accepting the limitations of supply of such material things as paper, would not live in this smaller house with any less dignity or with any less spiritual grace.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Staff

Recipe for Preventing Priorities Shutdowns

SOME WEEKS AGO the ELECTRICAL WORLD suggested editorially that defense officials were overlooking a bet in not recruiting the power salesman to help them find small firms normally producing peacetime goods and facing shutdown due to inability to get materials which could take on munitions contracts. Defense Contract Service executives, primarily engaged in this problem, looked kindly upon the suggestion.

But, they said, the biggest problem was not to find concerns without defense business which could take orders. The major problem, rather, was to convince the Army and Navy contracting officers that such concerns could effectively help speed defense —that they must get some defense work to survive if (as it is) the war program forces sharp curtailment in civilian goods output. The Army and Navy still are the contracting agencies for armament materials; OPM cannot actually spend any of the billions appropriated for defense.

Back Home Clamor

For many months past a few OPM executives have been harping on this subject of spreading defense work. Conspicuous in these ranks were Donald M. Nelson, director of purchases, and Sidney Hillman, OPM's co-director and labor division chief. How much heed was paid their pleas can best be illustrated by citing the fact that, through last May, 75 percent of Army-Navy supply contracts —nearly 10 billion dollars worth— had been placed with 56 corporations.

In recent weeks a groundswell of complaints from "back home" has been growing into an undeniable clamor from civilian industries with the wolf actually at their doors. The tentative OPACS recommendations of a 50 percent slash in output of such commodities as autos, refrigerators, washing machines and ironers, brought many an official (both in industry and in Washington) up with a sudden realization that famine threatened amid plenty.

Now, a direct action program radically altering Army and Navy procurement policies and designed to get orders to scores and hundreds of plants out in the cold has been drafted by OPM and has been agreed to by both the service departments.

DCS Sits In

Defense Contract Service has been "promoted" from a loose end unit in OPM's Production Division to an independent bureau reporting directly to Directors Knudsen and Hillman. DCS, furthermore, will "sit in the game" with the Army and Navy on procurement programming and policies, will be informed of all bids or negotiations before (instead of after) prime contracts are awarded. With these Army and Navy supply requirements in hand, DCS is empowered to recommend to the service agencies any of these steps to spread the orders:

1. Negotiated contracts in lieu of competitive bidding at a figure up to 15 percent higher than current quotations.

2. Placing of trial orders on a cost-plus-fee basis.

3. Placing contracts with manufacturers' pools which may be organized within a given community or industry.

4. Elimination of bid or performance bonds when necessary.

5. Inspection of products at plants to facilitate prompt payment.

6. Reimbursement of prime contractors for additional costs resulting from extension of such policies to subcontractors.

7. Elimination of the "latent defects" clause in contracts to relieve contractors of contingent liability.

Where any of these work-spreading methods is recommended, under the OPM-Army-Navy "treaty," the Secretary of War or Navy is duty bound to instruct his contracting officers to take appropriate steps to put them into effect in so far as they do not interfere with essential defense requirements. In addition, the agreement sets forth a number of drastic revisions in Army-Navy supply procurement policies all of which are aimed at giving civilian industry a part of the armament production job automatically.

Procurement Revisions

These include, in addition to notifying DCS of all proposed purchases in advance, provision for breaking down into optional units calls for bids for large quantities to permit smaller concerns to bid for appropriate amounts, with contingent authority to contracting officers to divide awards so that part of it goes to other than the lowest bidder; establishment of more exhibits, in readily available centers, of specific items broken down into components with description of tools and operations required; weighting favorably wherever feasible earlier-than-requested delivery dates proposed by a bidder; requirement that bidders state the minimum percentage of dollar value of prime contracts for more than $50,000 which will be subcontracted, such statements to become a firm part of the contract and to be weighted favorably in valuing bids; withholding of allocation of new tools until a contractor can establish that sufficient subcontracting facilities are not available within a reasonable distance.

Defense Contract Service, in its enlarged role, is represented in all OPM divisions and will provide regional advisory services for plant owners, or groups of them, seeking contracts or subcontracts. It is given the job of determining, for OPM certification to the Army and Navy, both communities and industries threatened by unemployment or bankruptcy resulting from defense dislocations to civilian industry. A case in point is DCS's survey of the washing machine in-

[*Continued on page* 120]

NEWS OF THE WEEK

Power Plans, Priorities Affected by SPAB Order

New set-up for defense administration, Supply Priorities and Allocation Board, recognizes OPM power unit as top planning agency for electricity supply

Reorganization of defense administration has left Secretary Ickes completely out in the cold. Not only is he now formally and officially subordinate to the new super-agency—Supply Priorities and Allocation Board—as concerns the public projects he controls, but also his ambition to become power czar is checkmated.

The President's executive order setting up the new board, headed by Vice-President Wallace, directs that it "review, clear and approve for execution all requests or proposals originating from other federal agencies, private industry or other sources for priority action with respect to procurement, transmission or transportation of materials, articles, power, fuel and other commodities."

OPM Power Unit

To utilities this means that the OPM power unit headed by J. A. Krug is formally recognized as the defense planning agency for electric energy. Except by completely upsetting the pattern, the President cannot now issue the Ickes-prepared executive order vesting power coordination authority in the Secretary of the Interior.

The new agency will set general policies, but both the initial spade work and the execution will lie in the hands of OPM. It is expected that two power matters will come before SPAB in the near future—a system of project priority rating for utility construction and some form of program for insuring continuing absorption of the capacity of generator output.

Mr. Krug and his priorities specialist, John C. Parker, are putting the finishing touches upon a project rating plan which now will be submitted to SPAB for approval. Once approved, the issuance of ratings will come from OPM's priorities division, which in normal course will defer to the power unit's judgment on specific cases.

The reshuffling of defense administration presages also somewhat better times for civilian industry. The executive order shifted the civilian supply division of OPACS to OPM and flatly and completely gives to the new agency full authority to allocate materials between defense and civilian uses, as well as between competing defense and competing civilian channels. This means an end to the divided authority which existed under the administration of war and civilian economies by two separate agencies.

In addition, the realignment of personnel brings to the fore officials who have been most alarmed over the lack of positive planning in behalf of civilian industry. This is particularly true regarding Donald M. Nelson, who is executive director of the new board and successor to Edward Stettinius as director of priorities. Net result may not be to give civilian industry any greater supply, but instead to provide more positive advance indications of the

URBAN HYDRO—Cataract development of Cumberland County Power & Light on Saco River in the heart of Biddeford-Saco, Maine, containing a 9,500-kva., 11.5-kv. G.E.-S. Morgan Smith remote-controlled vertical generating unit operating under 44 ft. normal head. The installation, which utilizes the river flow with a design of completely modern characteristics, is a valuable asset to the two cities and to the system in general

BEST-SPENT UTILITY MONEY last week went for 324 cartons of cigarettes that Chicago's Commonwealth Edison Company sent to its boys among national guardsmen, draftees and reserve officers in both branches of the service. Picayune in amount, it brought welcome cheer at a time when morale of servicemen was much in the news

amount to be available and more readily to integrate into defense activity the manufacturing capacity which must cease normal operations.

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Two Iowa Utilities Plan to Interconnect Lines

Des Moines Electric Light Co. and the Iowa Southern Utilities Co. have announced plans for construction of a $250,000 transmission line from Creston to a point 10 miles south of Adel, Iowa, a distance of 31 miles. The new lines will connect the two electric power systems and make possible the interchange of energy to insure continuity of service, besides permitting the more effective use of plant facilities. The two systems are already connected at Oskaloosa and Newton, Iowa. The plans include installation of an $11,000 switching station at Adel.

Des Moines Electric Light Co. will bear approximately one-third of the cost of the new line, and in addition will spend $35,000 in improving its present power line from Des Moines to Adel.

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Seattle Wage Increase

An ordinance appropriating $40,000 to give employees of Seattle City Light's operating division wage increases averaging 10 percent has been passed by the City Council.

Georgia Power Sponsors Documentary Farm Film

To help carry the story of the advantages of electric service to farm families, the Georgia Power Co. has just enlisted the medium of motion pictures with sound and color. The Georgia utility co-operated with the Georgia Agricultural Extension Service in the production of a 30-minute colored sound film entitled "Our New Farm."

An "All Georgia" picture, it is the first of a series to be produced and distributed by the Georgia Agricultural Extension Service in its new visual education program. The picture visualizes and describes the ways a typical Georgia rural family adds to its comfort and income by putting electricity to work on an old-fashioned farm.

"Our New Farm" is being shown to rural groups in Georgia at an extensive series of community meetings conducted by county agents and home demonstration agents.

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Applies for Hydro Unit

Federal Power Commission has announced receipt of a declaration of intention by the Consolidated Water Power Co., Wisconsin Rapids, Wis., to construct a hydro-electric development on the Wisconsin River in Portage County, Wis. The proposed project will include a power house with installed capacity of 7,200 kw.

NEWS BRIEFS

DEVELOPMENTS IN pole top resuscitation methods and steps taken by utilities to protect their properties in the defense emergency will be featured in the sessions of the Public Utilities Section at the 30th National Safety Congress in Chicago, October 6 to 10.

WIND POWER ON A MAJOR SCALE, not just for charging radio batteries or lighting a lamp or two, but actually working as a production component in an electric utility system, will soon become a reality in this country. Reports from Vermont are that the wind power unit on Grandpa's Knob is about ready to start working. Forerunner of the complete story in ELECTRICAL WORLD is the picture on page 67 of this issue.

ELECTRIC PUMPING is to be installed at five out of six stations on the 250-mile Portland (Me.)-Montreal crude oil 12-in. pipe line to be completed late this fall. There will be two 500-hp. pumps per station, at least one of which will be run 24 hours per day and seven days per week. Sixty-thousand barrels per day can be pumped through each station, saving six days in tanker time from the former round trip by water. Central station service will drive the pump motors.

IT APPEARS they are having trouble getting Grand Coulee started. The first 108,000-kw. main generator burned out a bearing in acceptance tests in July. Repairs were made and tests were resumed in August, when the same thing happened, although damage was less serious on this occasion.

AT NORTHEAST POWER PLANT of Kansas City Power & Light Co. work is nearing completion on the change-over of two more boilers from coal to gas or oil firing. With the change seven of the plant's fourteen boilers will be able to burn either gas or oil fuel. The change from stoker firing to gas or oil burners will increase the steaming capacity of the boilers from 80,000 to 125,000 lb. of steam per hour.

REA REPORTS THAT RECORDS kept by 74 Indiana farmers' wives show the care of the electric range takes but a fraction of the time for other fuel stoves, as follows: Electric ranges, 26 minutes a week; oil, two hours, and coal and wood, three hours.

IN SEVEN STATES, North and South Carolinas, Idaho, Nevada, Tennessee, Utah and Washington, electric ranges exceed gas ranges in use, according to George A. Hughes, Hotpoint chairman before the Senate finance committee.

Defense and Regulation Topics at NARUC Meet

Commissioners consider added utility capital required by defense operations, competitive bidding developments and validity of comparative rate reports — James of Missouri new president

Effect of the National Defense Program and of certain federal regulatory activities upon state utility regulation occupied a large share of the attention of delegates to the 53d annual National Association of Railroad and Utilities Commissioners convention in St. Paul last week.

One resolution referred to the executive officers for action proposes creation of a special committee to study the problems of utilities faced with increasing capital investment to meet defense needs. Particular emphasis of such a study, the resolution directs, is outlining a policy to guide state commissions in handling disposition of such investments not needed after the war. One entire convention session was devoted to discussion of power problems in the defense program, with Chairman Leland Olds of the Federal Power Commission and Commissioners Frederick G. Hamley, Washington, and Walter R. McDonald, Georgia, comprising the panel.

Consider Federal Activities

Two activities of federal agencies came under the convention's scrutiny. The association's committee on cooperation between state and federal agencies was directed to consider with the Securities and Exchange Commission the problem of coordinating state and government activities under SEC's competitive bidding rule. The NARUC resolution neither supported nor condemned the rule, but was confined solely to a statement that coordination of effort is necessary.

FPC's various comparative rate reports were given limited indorsement in a detailed discussion of the values and faults of average rate comparisons contained in the report of the committee on progress in public utility regulation. "It must be conceded that average costs per kilowatt-hour," the report says, "if employed indiscriminately as a criterion to compare rates for electric service in various municipalities or in different areas, may possibly lead toward distorted conclusions." As illustration, the report cited variations in the average rates of a number of towns served by TVA under identical rates.

The convention elected J. D. James, chairman of the Missouri commission, president after Federal Communications Commissioner Wakefield, elevated from first vice-president, resigned in deference to the precedent against a federal official heading the association. Frank W. Matson of Minnesota was named first vice-president and Wade O. Martin of Louisiana second vice-president. John Benton and Ben Smart were renamed general solicitor and general secretary

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Deny Oregon Utility Bonneville Power

Paul J. Raver, Bonneville Power Administrator, has told the Eastern Oregon Light & Power Co. that he cannot fill the company's application for 3,500 kw. of Columbia River power.

In a letter to LeRoy A. Grettum, manager of the company at La Grande, Ore., Administrator Raver pointed out that the Union County Public Utility District had applied some time ago for the purchase of Columbia River power, and that under the terms of the Bonneville Act application of publicly owned agencies must be given preference and priority over those of private utilities in the sale of electricity by the administration.

He stated that the company had recently refused to sell its entire system at a fair price and that he understood that the district was prepared to buy the company's distribution facilities located within the district boundaries.

He pointed out also that the present defense emergency is making unusually heavy demands upon the government for additional power.

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FPC Dismisses Petition for Utility Purchase

Federal Power Commission has dismissed, for want of jurisdiction, the application of Portland General Electric Co., Portland, Ore., for authority to purchase the Butte Light & Power Co. of Scotts Mills, Ore., for a cash consideration of $20,000 subject to certain adjustments.

The dismissal was based on a finding that "the electric facilities proposed to be purchased consist solely of local distribution facilities, the sale of which is not subject to the jurisdiction of the commission within the meaning of Section 203 of the Federal Power Act."

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Cuts Rural Assessment

Dropping from an originally much higher assessment, the state Tax Commission has set assessments for New Mexico's four rural electrification cooperatives at $20 per wire-mile.

PLANT FOUNDATION—View shows work in progress of laying the foundation for the Burlington station of Public Service Electric & Gas Co. of New Jersey, which will house new 100,000-kw. Westinghouse unit and two B. & W. boilers

Engineers' Responsibilities Keynote at Yellowstone

Pacific Coast A.I.E.E. convention hears Prince on problems and role of engineers "after the emergency"— Sessions on protective devices, first tests of 138-kv. air-blast circuit breaker

In an atmosphere of scenic grandeur that served as a background to the excellence of the program and the seriousness of the discussions, 321 members and guests at the annual Pacific Coast Convention of the A.I.E.E. at Yellowstone National Park, August 27-29, studied objectively some of the engineering problems that are likely to follow the present emergency.

One session centered attention on the subject "After the Emergency, What." In this paper D. C. Prince, the newly elected president, pointed out that the highest standard of living will be obtained only by giving people work, and if private industry is to accomplish this it will have to make and carry out plans. These plans will not be in the form of dictation from central authority, such as in Germany, Italy and Russia, but will rather represent the planning of local groups who will solve local problems. When it is found that a problem involves more than a local group it will have to be solved by all the people concerned, which is the essence of our democratic process.

The thought was expressed that engineers are in a strategic position because they are trained in planning that involves accurate calculations of labor, material and all the other elements of the problem. A great many people other than engineers will have to do their part, but it was Mr. Prince's belief that the leaders of labor, industry, business, agriculture and banking can and will all work together to produce the highest standard of living that this country has ever known.

Protective Devices

At another session, devoted to protective devices, some new and up-to-date performance data for line type lightning arresters rated 20 to 73 kv. were presented by a special committee. Two new devices were described to provide greater reliability for distribution circuits. A. E. Brock (Pacific Electric, San Francisco) discussed a new automatic service restorer featuring high interrupting capacity, variable time and current adjustments and a means of storing operating energy through a low-speed vibrator motor and spring which assures an infinite number of intermittent operations. A low-maintenance cost, small, automatically reclosing, self-protected oil circuit breaker for extended distribution circuits was described by H. L. Rawlins and J. M. Wallace (Westinghouse). The device is aimed at eliminating service trips on temporary faults and at restricting outages to the immediate vicinity of a permanent fault.

Air-blast Tests

Tests on a high-speed 138-kv. air-blast circuit breaker cited by Philip Sporn (American Gas & Electric Service Corp.) and H. E. Strang (General Electric) indicate performance of this new form of interrupting device to be at least the equivalent of present forms of conventional oil breakers. Tests were made to prove interrupting ability under field and service conditions and also to determine operating characteristics on super-speed reclosing duty. This new type of breaker is in an advanced development stage and trial installations are about to be put in service in order to obtain additional field experience. A considerable amount of discussion on this paper indicated an intense interest in this new device.

A report of an investigation made by H. S. Shott and H. A. Peterson of the factors affecting neutral instability of wye-grounded potential transformer circuits revealed that regions of instability sometimes occur when this method is employed to detect ground faults. Conditions under which incorrect fault indications may be obtained were set forth. Another paper, in which Peterson collaborated with S. B. Farnham and E. M. Hunter (General Electric) showed how the same miniature system method of representation was used to determine data on modern ground fault neutralizer design and application. It was shown that ground fault neutralizer applications effectively avoid system overvoltage difficulties.

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Approve Nisqually Fund

The City Council of Tacoma, Wash., has passed an ordinance appropriating $300,000 from the City Light fund to pay part of construction costs of the proposed Nisqually power project and authorizing the corporation counsel to purchase or condemn needed property in Lewis County courts. The city has filed an application with the Federal Power Commission for a major license to construct two hydro-electric developments on the Nisqually River in Thurston, Pierce and Lewis counties, Wash. The upstream development will include a dam with installed capacity of about 50,000 kw. and the downstream development a power house having installed capacity of about 64,000 kw.

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Oregon Commission Approves Tax Clause

New rates for residential and commercial service put into effect this summer by Mountain States Power Co. in its Willamette Valley, Ore., district include a tax surcharge added to the base rate in the form of a percentage representing the ratio of the company's taxes to operating income. These schedules have been approved by the Public Utilities Commissioner of Oregon.

In both the residential and commercial schedules, which start with a top of 3.2 cents per kilowatt-hour and run down in steps to 9 mills in the residential and 8.5 mills in the commercial, the tax surcharge, established at the time of filing, is 16.75 percent of the total bill figures on the base rate. This percentage is subject to revision each year on approval by the commissioner.

Commenting on the rates, Z. E. Merrill, president of the company, states: "We believe that this method of billing will make the public more tax conscious and will make the rate schedules more flexible when endeavoring to reflect changes in taxation."

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Aluminum Expansion Starts Power Argument

Sweetness and light and happy concord do not prevail in the picture of expansion of aluminum production for defense. On August 20 there was an announcement by Jesse Jones, Federal Loan Administrator, that the Defense Plant Corporation had entered into a contract with the Aluminum Company of America providing for three new smelting plants in New York, Arkansas and near Bonneville Dam, to produce 340,000,000 lb. of aluminum per year. On the same day, in a news release, Paul J. Raver, Bonneville Administrator, complained that almost three months had elapsed since Bonneville had agreed to have service ready early in 1942 for three aluminum plants

at Tacoma and Seattle, Washington, and at Cascade Locks, Oregon. "We are disturbed," he said, "by rumors of a possible change in the locations of two of these plants." The delay, he charged, was costing the defense program at least 250 tons of aluminum per day.

Learning of the charges voiced by Mr. Raver, Mon C. Wallgren, junior Washington Senator and member of the Truman committee investigating the progress of the defense program, promised that the committee would go into the charges at hearings to be held in Seattle. Meantime reports from Arkansas indicated that supply of power for the plant in that state, and for a companion plant for the processing of bauxite to alumina, was still pretty much a moot question. According to one story, REA would build a plant to furnish the power. Then came another saying that OPM would do it. Whether the plant should be built where condensing water was available and the gas for fuel piped to it or built at the gas field and the water piped, whether alternating or direct current generation should be employed, these were questions that bounced back and forth in the Arkansas arena.

In a few weeks the 1,000-kw. wind power plant on Grandpa's Knob is expected to be in operation. Recent trial spins of the huge air foil blades with a wing spread of 175 feet were highly successful

Federal Order Restricts Appliance Sales Terms

Larger down payments and eighteen-month time period will force radical change in sales practices designed to encourage use of major appliances

Included in the list of durable consumer goods items on the purchase of which the Federal Reserve Board has ordered curbs to installment credit terms are practically all domestic electric appliances. In all cases the installment term is limited to eighteen months and in some the minimum monthly payment may not be less than $5. Down payments for various appliances are specified: 20 per cent on refrigerators, washing machines, ironers, vacuum cleaners, ranges, space heaters, dishwashers, room-unit air conditioners, sewing machines and radios; 15 per cent on water pumps, home air-conditioning systems, attic fans and water heaters.

This regulation of installment purchase has two purposes—the first to dampen public demand for goods in whose manufacture are used materials and production facilities needed for national defense and the second to contribute toward efforts to restrain inflationary forces. Also, money turned from installment purchases can be used to buy defense bonds.

Will License Sellers

The order also places all "persons, partnerships and corporations" engaged in installment selling of the items listed under a nation-wide licensing system. Every such seller must register with one of the twelve Federal Reserve banks or with one of their branches before December 31, 1941. Any questions in relation to the order may be sent to the banks or branches.

The order went into effect September 1 and no installment sales contract entered into before that date is affected by it. The action was hurried because the board desired that the inevitable period of speeded-up buying and intensified selling previous to effect of the order should be as short as possible.

Comment from the utility field on this regulation of installment sales is not altogether unhappy. Although probably a preponderance of sales of the heavy appliances—refrigerators, ranges and water heaters—has been on much easier terms than those of the order, it is felt that the result of the order will be considerably modified to make it less onerous by two conditions. There will be fewer of these appliances to be sold and the buyers will be in better position to pay for them. The reduction in sales volume so easy to be foreseen will not result primarily from this curb in installment selling, but rather from the reduced production of the appliances themselves.

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Hydro Gets Beauharnois Power in Advance

Anticipating the previously planned delivery date by more than two months, Beauharnois Power Co. recently stepped up its supply of power to Ontario Hydro by 50,000 hp., bringing the total taken by Ontario Hydro to 200,000 hp. This earlier delivery was made possible by the fact that the lines constructed to carry the power were finished ahead of schedule, and, in view of the demand for power in Ontario, the Hydro organization was glad to take the additional block as soon as available.

With regard to the proposed acquisition of Beauharnois by Quebec Province, it is understood that definitive negotiations between government representatives and the company have not yet been opened, but that the government representatives are gathering information in preparation for such negotiations.

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Utility Officials Report on Daylight Saving Plan

Daylight saving time has not effected any saving in consumption of electric power on the part of customers of Virginia Electric & Power Co., an official said. He stated that increases in some localities, offset by decreases in others, were practically unexplainable.

Officials of the Appalachian Electric Power Co. in Roanoke, Va., said that they had insufficient time in which to determine the effect of daylight saving on their output, and a spokesman for the Virginia Public Service Co., Alexandria, Va., likewise was unable to give any figures showing an increase or decrease in power production attributable to the change in time.

$4,000,000 Rate Cut Goes Into Effect

The largest single electric rate reduction in the history of the Philadelphia Electric Co.—$4,000,000 annually—recently ordered by the Pennsylvania Public Utility Commission, was announced effective September 1 by H. P. Liversidge, president.

In making formal announcement of the reduction, Mr. Liversidge pointed to the fact that electric rates have been definitely lowered in every year, with a single exception, since 1928, and that these reductions, including the one effective September 1, represent total annual savings to customers of more than $20,000,000.

All classes of electric customers are benefited by the new schedules—residence customers saving in excess of $1,250,000; the smaller commercial and industrial users obtaining about $1,970,000, and the larger commercial and industrial customers slightly more than $635,000 anually. Savings will also accrue to the city and federal governments and to various municipalities in the company's service area.

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F. H. Babcock Dies

Frederick H. Babcock, manager of the central station department of the New York district of the General Electric Co., died on August 31 in New York, after an illness of several months. He was 54 years of age.

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Distribution Units Sought by Utility

Montana-Dakota Utilities Co., Minneapolis, Minn., has applied to the Federal Power Commission for authority to buy certain properties of Mountain States Power Co., serving Baker, Plevna and Ismay, Mont.

In the application Montana-Dakota Utilities Co. says it proposes to give Mountain States Power Co. a purchase money note for $95,000 for the properties. Application for authority to issue the $95,000 purchase money note, and other purchase money notes, aggregating $245,000, was filed by Montana-Dakota on July 29.

The proposed transaction, the application says, will automatically terminate the existing contract under which Montana-Dakota Utilities Co. has been supplying power, delivered at Baker, to Mountain States Power Co. The application states that the proposed acquisition will be consistent with the public interest, since the properties to be purchased, which serve only Baker, Ismay and Plevna, Mont., are contiguous and interconnected with properties of Montana-Dakota Utilities Co. and are not connected with the other properties of Mountain States Power Co.

MEETINGS

International Association of Electrical Inspectors—Western section, Hotel St. Paul, St. Paul, Minn., September 8-10. F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind.; eastern section, Mayflower Hotel, Washington, D. C., September 22-24. F. N. M. Squires, secretary, 85 John St., New York, N. Y.; southern section, McAllister Hotel, Miami, Fla., September 29-October 1. Joseph Whitner, secretary, P. O. Box 1743, Atlanta, Ga.

American Chemical Society—Symposium on Electrical Insulation, sponsored by the committee on chemistry. National Research Council, Atlantic City, N. J., September 11. R. N. Evans, Consolidated Edison Co., 55 Johnson St., Brooklyn, N. Y.

Rocky Mountain Electrical League—Annual convention. Stanley Hotel, Estes Park Colorado, September 11-13. George E. Lewis, manager, Gas and Electric Bldg., Denver, Colo.

Wisconsin Utilities Association—Accounting section, electric, gas and transportation. Lawsonia Hotel, Green Lake, Wis., September 12-13; electric section, Hotel Schroeder, Milwaukee, October 13-14. A. F. Herwig, executive secretary, Room 502, Brunder Bldg., 135 West Wells St., Milwaukee, Wis.

Illuminating Engineering Society—Annual convention, Atlanta-Biltmore Hotel, Atlanta, Ga., September 22-25. Frank G. Horton, executive secretary, 51 Madison Av., New York, N. Y.

Association of Iron and Steel Engineers—Annual convention, Cleveland Public Auditorium, Cleveland, Ohio, September 23-26. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Indiana Electric Association—Annual fall meeting French Lick Springs Hotel, French Lick, Ind., September 24-26. R. E. Bloosom, secretary, 1414 Circle Tower, Indianapolis, Ind.

Southeastern Electric Exchange—Engineering and operation section, Suwanee Hotel, St. Petersburg, Fla., September 25-26. J. W. Talley, executive secretary, 303 Haas-Howell Building, Atlanta, Ga.

Electrochemical Society—Fall meeting, Chicago, Ill., October 1-4. Colin G. Fink, secretary, Columbia University, New York, N. Y.

Edison Electric Institute—Meter and service committee, New Ocean House, Swampscott, Mass., October 2; prime movers committee, St. Louis, Mo., October 6-7; electrical equipment committee, Hotel Cleveland, Cleveland, Ohio, October 13-14; transmission and distribution committee, Netherland-Plaza Hotel, Cincinnati, Ohio, October 20-22. Col. H. S. Bennion, managing director, 420 Lexington Av., New York, N. Y.

Public Utilities Association of the Virginias—First annual convention, The Greenbrier, White Sulphur Springs, W. Va., October 3-4. A. Bliss McCrum, secretary, 612 Charleston National Bank Bldg., Charleston, W. Va.

National Electrical Contractors Association—Fall meeting, Rice Hotel, Houston, Tex., October 6-8. L. W. Davis, general manager, 420 Lexington Avenue, New York, N. Y.

National Safety Council—National Safety Congress and Exposition, Stevens Hotel, Chicago, Ill., October 6-10. W. H. Cameron, managing director, 20 North Wacker Drive, Chicago.

American Institute of Electrical Engineers—South West district, Coronado Hotel, St. Louis, Mo., October 8-10. H. H. Henline, national secretary, 29 West 39th St., New York, N. Y.

American Society of Mechanical Engineers—Fall meeting, Louisville, Ky., October 13-15. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

National Electrical Wholesalers Association—Semi-annual convention, Hotel Statler, Detroit, Mich., October 14-17. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

American Welding Society—Annual meeting in conjunction with National Metal Exposition, Bellevue Stratford Hotel, Philadelphia, Pa., October 19-24. Miss M. Kelly, secretary, 29 West 39th St., New York, N. Y.

National Electrical Manufacturers Association—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 27-31. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

Commonwealth Edison Has Added 92,000 Kw.

During the past four months generating capacity totaling 92,000 kw. has been added to the system of the Commonwealth Edison Co. at Crawford and Northwest stations, it was disclosed recently. At Crawford station the net effective capacity has been increased 30,000 kw. by recently completed provision for a supply of washed coal. At Northwest station the first of the three new high-pressure boilers went into service in March. Since that time the remaining two were placed in operation, increasing station capacity 62,000 kw. The new boilers have returned to service certain generating units which were without sufficient boiler capacity.

Capacity at Northwest station will be further increased within the next few months on completion of the new 50,000-kw. topping turbine.

According to previously published plans, the Edison company expects to spend $120,000,000 during 1941, '42 and '43, to provide for emergency and normal power requirements in Chicago. About one-third is to be spent for additional generating capacity. Under the contemplated program a total of 466,000 kw. of additional generating capacity will be made available over this three-year period.

In addition to the 50,000-kw. generating unit and the additional boiler capacity at Northwest station, already mentioned, two turbo-generators for Fisk station have been ordered, both of 150,000 kw. capacity. One will be in service in the fall of 1942 and the other in the fall of 1943. A new 12,500-kw. topping turbine has been ordered for the Aurora station of the Western United Gas & Electric Company, a subsidiary organization, and will be in service in 1942. Public Service Company of Northern Illinois is proceeding with the installation of a 25,000-kw. high-pressure topping unit and additional boiler capacity at Joliet station, which is to be completed this year. The arrangements for a supply of washed coal for Crawford station, already mentioned, have added 30,000 kw. to the station's effective capacity through improved boiler performance.

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Plans New Building

Detroit Edison Co. has approved plans for the erection of a new one-story office and service building at Harbor Beach.

Contract for the construction has been awarded to John Paison, Bad Axe, Mich., and work will be placed under way at once.

Energy Output Takes a Jump

After dropping back in the previous week energy output of the electric light and power industry resumed its upward climb and reached 3,223,609,000 kw.-hr. in the week ended August 30, according to Edison Electric Institute figures.

This output is 24 percent higher than in the corresponding week of 1940, which was in turn 10 percent above its parallel week in 1939. The difference in these percentages is obviously the result of increased industrial activity in defense production. The 24 percent increase is now the highest yet attained by any week in 1941 over its corresponding week in 1940.

The larger output appears in all of the figures of percentage changes for geographical areas except in the cases of the Central Industrial and West Central areas. Again the Southern States area stands highest in the regional comparison, but New England appears to be catching up rapidly.

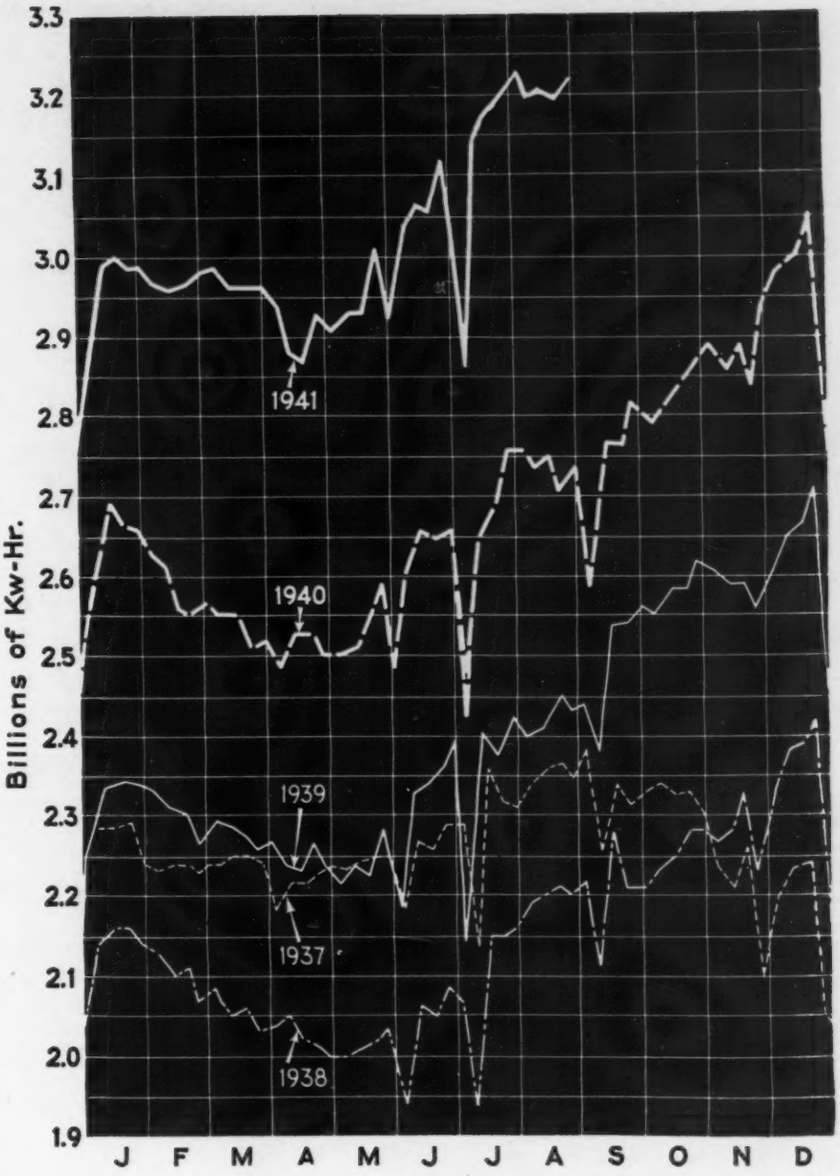
Weekly Output Millions Kw-Hr.

1941		1940		1939	
Aug. 30	3,224	Aug. 31	2,601	Sept. 2	2,357
Aug. 23	3,193	Aug. 24	2,714	Aug. 26	2,434
Aug. 16	3,201	Aug. 17	2,746	Aug. 19	2,454
Aug. 9	3,196	Aug. 10	2,743	Aug. 12	2,413
Aug. 2	3,226	Aug. 3	2,762	Aug. 5	2,413
July 26	3,184	July 27	2,761	July 29	2,342

Per Cent Change from Previous Year

	Week Ending		
	Aug. 30	Aug. 23	Aug. 16
New England	+22.5	+20.1	+23.0
Mid-Atlantic	+16.0	+15.1	+13.2
Central Industrial	+19.3	+20.2	+19.4
West Central	+12.1	+16.2	+17.5
Southern States	+29.8	+24.2	+21.8
Rocky Mountain	+ 8.5	+ 4.5	+ 3.1
Pacific Coast	*+10.5	*+10.3	*+ 9.0
Total United States	+17.8	+17.7	+16.6

* Percentage should be higher — data under revision.



No Power Shortage, Says E. R. Hoffman of Seattle

There is no power shortage in the field served by Seattle City Light, according to E. R. Hoffman, superintendent of City Light, and the city utility is supplying all demands upon it for electrical energy. However, Mr. Hoffman said that City Light is making plans to store more and more of its Skagit River water and has its Lake Union auxiliary steam plant ready for operation, if demand for power should surpass the output of the hydro-electric plant.

Pointing out that it costs twice as much to operate the steam plant, Mr. Hoffman declared it will not be used unless it is absolutely needed.

He also stated that City Light cannot take on the Bremerton Navy Yard as a customer, because it would require construction of a heavy, costly submarine cable between Seattle and Bremerton, on which delivery would be extremely uncertain.

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Appliance Campaign Ends in Sell-Out

Consolidated Edison Co. of New York has announced the termination of its double bargain appliance campaign. All available stock was sold. The campaign, featuring a Eureka tank-type vacuum cleaner and a Schick flyer shaver, beat all previous records, selling 32,000 units in thirteen working days and this record was made in the height of the vacation season.

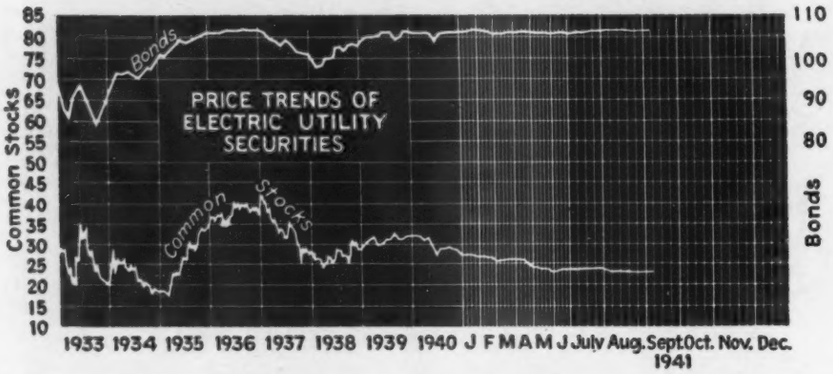
Orders for 125,000 of the vacuum cleaners were placed December 19, 1940, and the campaign was planned to run three months. When defense needs curtailed manufacturer's supplies sales were averaging well above 3,000 a day.

The vacuum cleaner, with a certified regular retail value of $49.95, was sold for $22.90 cash, or $2 down and $2 a month for eleven months, and the shaver, valued at $12.50, for $1 in combination with the cleaner.

Consolidated Edison Co. has announced to its cooperating dealers a new appliance campaign which started this week. It will feature new standard brand electric appliances at bargain prices.

"Through these campaigns the Consolidated Edison System companies are demonstrating the fact that under proper direction and through proper planning inflation in the price of electric appliances need not take place," said E. F. Jeffe, vice-president.

Utility Stocks Advance; Bonds Hold Firm


Common Stocks
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
Bonds
110 100 90 80
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
1933 1934 1935 1936 1937 1938 1939 1940 J F M A M J July Aug. Sept. Oct. Nov. Dec. 1941

Electric light and power stocks continued on the upward trend during the past week. "Electrical World" index advanced to 23.6 from 23.4 the preceding week; last year, 29.0. Bonds held firm—"Electrical World" index, unchanged at 105.8

SEC Issues Order on Virginia Unit

Securities and Exchange Commission has served notice on Virginia Public Service Co. that it must be prepared to show why it need not revamp its corporate structure.

According to the board such a step appears necessary because there is an inequitable distribution of voting power among its security holders which should be rectified. The SEC order sets September 23 as the hearing date.

This is the second recent move against the company, an operating subsidiary of the Associated Gas & Electric System. Several weeks ago the SEC turned down a proposed refinancing program of the company.

Four banking groups have submitted recapitalizing and refinancing plans for the utility. At the time the SEC denied the utility's application to proceed with the previously proposed refinancing plan, the commission said its staff would be glad to assist the company in formulating a new program. Accordingly the four banking groups plans will be taken to the SEC for discussion.

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United Light Will Not Fight SEC Ruling

United Light & Power Co. announced from its Chicago headquarters last week that it will pursue a policy of "frank cooperation" with the S.E.C.'s recent order requiring geographical integration under the holding company act (ELECTRICAL WORLD, August 16, page 20).

Without interfering with the right of security holders to oppose enforcement of the order, officials of the company declared that it "will meet this situation in the utmost good faith and believes that it can arrange affairs—without imposing undue sacrifices upon the part of security holders."

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Starts Action Against Illinois-Iowa Unit

Securities and Exchange Commission has issued an order instituting proceedings under the holding company act against the Illinois-Iowa Power Co. to see if its corporate structure meets the act's requirements. The company is a part of the North American System.

It is a proceeding similar to those begun recently against two subsidiaries of Electric Bond & Share Co.—Florida Power & Light Co. and Pennsylvania Power & Light Co.—and against Virginia Public Service Co. of the Associated Gas & Electric System.

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Report Champions Cause of Holding Company

Engineers Public Service Co. has submitted to Securities and Exchange Commission a series of economic studies designed to show that both utility rate payers and investors would be the ultimate losers if the "death sentence" section of the Public Utility Holding Company Act were carried out.

Prepared for Engineers Public Service by Dr. Merwin H. Waterman, professor of finance at the University of Michigan, the studies purported to show that consumers pay lower rates for utility service under holding company ownership than for service by independently operated properties.

Asserting that the objectives of the Holding Company Act were directed to protecting the rate-payer and the investor, the studies maintained that these purposes "cannot be furthered by destroying holding companies" under Section 11, or the "death sentence" clause.

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New Plan Offered by Florida Unit

Florida Power & Light Co.'s request that the hearing before the Securities and Exchange Commission be deferred on the grounds that it has formulated a new plan for refinancing the publicity held securities of the company and wishes to submit it to the commission, has been granted by SEC. Accordingly the hearing on corporate simplification actions against Florida Power & Light, American Power & Light and the Electric Bond & Share Co. has been postponed from August 11 to September 22.

The company stated that under its proposed plan the amount of its publicly held securities will be substantially reduced and that in connection with it American Power & Light will surrender to Florida Power & Light all securities of Florida Power now owned by American Power which are senior to Florida Power's common stock.

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Insurance Firms Add to Utility Investments

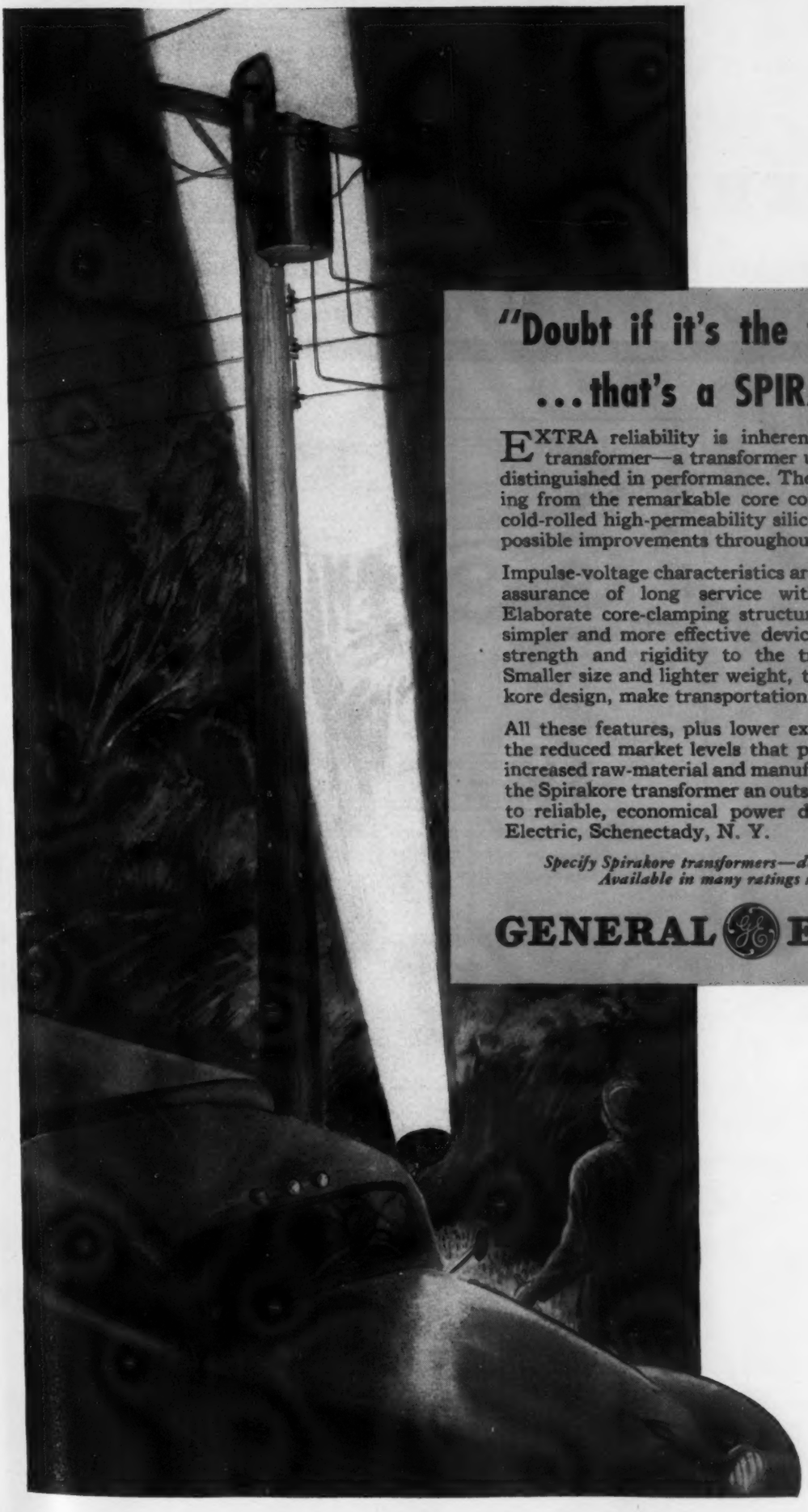
Considerably larger purchases of utility and industrial bonds by life insurance companies in the first six months of this year and somewhat smaller investments in U. S. Government issues are shown in figures compiled by the Institute of Life Insurance.

The gain was particularly pronounced in utilities, where first half investments were estimated at $545,000,000, against $268,000,000 in the corresponding 1940 period. In industrials, the 1941 total was $404,000,000, against $307,000,000 last year. In U. S. Governments there was a decrease to $443,000,000 from $480,000,000 in the first half of 1940.

Utility Reports

	Net Income 1941	1940
*Carolina Power & Light	$3,665,414	$2,988,368
*Commonwealth & Southern and subs.	14,498,673	13,558,470
†Duquesne Light	10,471,833	10,290,993
*Houston Ltg. & Power	3,068,638	2,879,745
*Kansas Gas & Electric	1,619,530	1,317,081
*Minnesota Pwr. & Lt.	1,518,969	1,423,932
*Montana Power and subs.	3,787,390	3,894,987
†National Pwr. & Lt and subs.	8,618,423	9,075,040
*New Orleans Pub. Serv.	2,573,899	2,672,254
†Pacific Gas & Electric	23,249,150	25,307,311
*Pennsylvania Pwr. & Lt.	8,268,750	9,570,506
*Utah Power & Light and subs.	1,967,852	1,668,774
*Washington Water Pwr. and sub.	2,216,453	3,148,726

* Twelve months ended July 31.
† Twelve months ended June 30.



"Doubt if it's the transformer ...that's a SPIRAKORE!"

EXTRA reliability is inherent in the Spirakore transformer—a transformer unique in design and distinguished in performance. The advantages resulting from the remarkable core construction, utilizing cold-rolled high-permeability silicon steel, have made possible improvements throughout the transformer.

Impulse-voltage characteristics are better—for greater assurance of long service without interruptions. Elaborate core-clamping structures are replaced by simpler and more effective devices that give greater strength and rigidity to the transformer interior. Smaller size and lighter weight, typical of the Spirakore design, make transportation and handling easier.

All these features, plus lower exciting currents, and the reduced market levels that prevail in the face of increased raw-material and manufacturing costs, make the Spirakore transformer an outstanding contribution to reliable, economical power distribution. General Electric, Schenectady, N. Y.

Specify Spirakore transformers—designated Type HS
Available in many ratings up to 500 kva

GENERAL ELECTRIC

402-28-5100

OPERATING PRACTICES

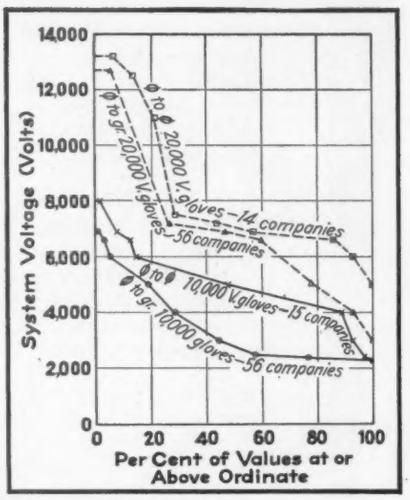
Testing Practices for Protective Equipment

By I. W. GROSS
American Gas & Electric Service Corporation, New York, N. Y.

Practices in general use for testing rubber goods and other insulating materials, including British standard gloves, are listed in the accompanying table. In our own company we have recently added the practice of testing the wood stick insulation on hot line tools by power-factor test and rating it on the watts loss observed across some 3 to 4 in. of wood; 10 kv. is used across these wood sections and where the watts loss in the tested section exceeds 0.7 watt for a 3-in. section and 1.0 watt for two 4-in. sections in parallel the stick is considered unsuitable for further use.

In our experience with testing wood of hot line tools and switch sticks in this way it is estimated that approximately 2 percent of hot line sticks so tested have been found bad and approximately 4 percent of the regular switch sticks have required reservicing.

Recent development of protective spur guards and insulating rubbers seems to indicate that rubber equipment either alone or in combination with other protection will find a recognized and accepted use for protection of workmen in maintaining lines in the general class of 12 kv.



ROUNDUP of utility practices on maximum permissible voltages for rubber gloves on live-line maintenance—data from 80 companies

•

Recirculation Scheme Eliminates Slush Ice

To eliminate frazil ice conditions at the intake trash racks of the Nebraska Power Company's Omaha plant on the Missouri River a plank bulkhead and floating deflector are used to direct warm condenser discharge water toward the intake. The resulting recirculation keeps intake water temperature above 33 deg. By changing the number of planks in the

PLANK BULKHEAD in background and floating deflector, right, direct warm condenser discharge water toward intake (camera position) to stop frazil ice nuisance

General Utility Practices for Testing Protective Equipment

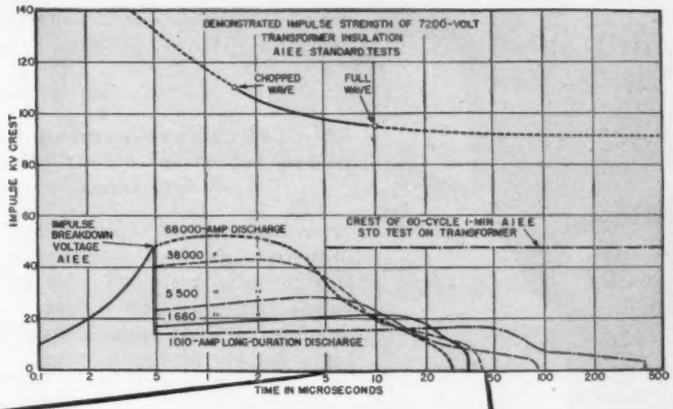
Material	Acceptance Test		Routine Test		
	Volts	Minutes	Volts	Minutes	Period
Class A gloves	16,000	1	10,000	1	2 wk. to 3 mo.
Class B gloves	14,000	1	10,000	1	2 wk. to 3 mo.
A and B gloves	10,000	3			
20,000-volt gloves	20,000	3			
Blankets	10,000 to 25,000 *	3	20,000	1	
Sleeves	10,000	3			
Hose	15,000 to 30,000	3			
Dead Ends (Pigs)	25,000				
Hats	20,000		20,000		1 mo.
Rubbers	12,000†		5,000	1	
Spur Guards	20,000				
Wood and barriers	Usually not tested				
Hot line tools	75,000/ft.	5	10,000/3 in. (power factor test)		
British glove tests					
600-volt gloves	5,000				
1,100-volt gloves	10,000				
3,300-volt gloves	15,000				

* 60,000 volts breakdown. † 32,000 volts breakdown.

You Get A Big EXTRA MARGIN OF PROTECTION with MODERN Pellet Arresters

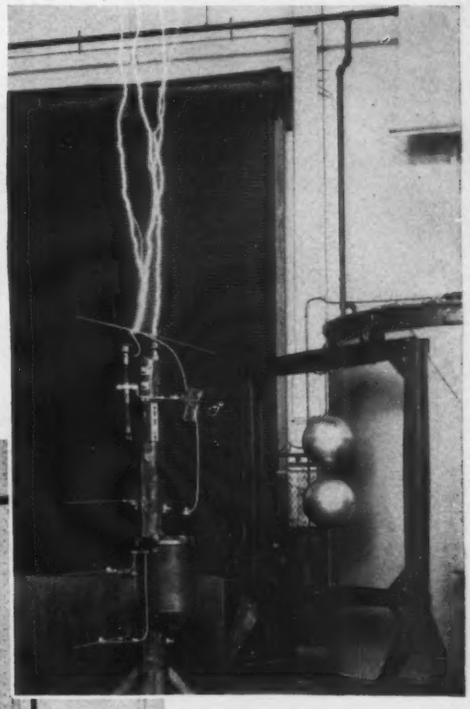
Even with severe lightning discharges, pellet arresters limit stresses to less than half the impulse test strength of the distribution transformer

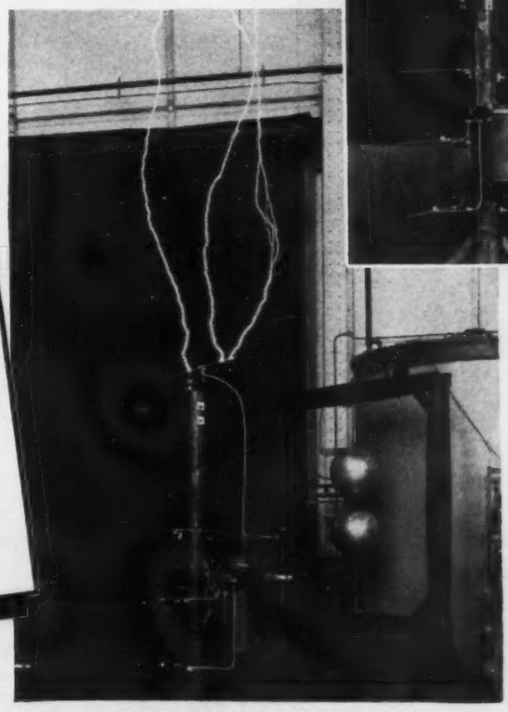
HERE'S PROOF OF THAT EXTRA MARGIN OF SAFETY. . .



◀ In this graph, the impulse volt-time oscillograms of the 9-kv pellet arrester are compared with the volt-time impulse test strength of a 7200-volt distribution transformer

. . . AND YOU ALSO GET EXTRA LARGE DISCHARGE CAPACITY





Pellet arresters mounted separately (above) or directly on transformer (left) withstand severe lightning strokes. Pellet arresters have discharge capacity in excess of the highest lightning discharge currents measured on distribution circuits.*

*See "*Discharge Currents in Distribution Arresters*," Electrical Engineering, *June, 1938.*

The Extra Values in Pellet Arrester Protection

1. You avoid repeated stresses close to the transformer strength.
2. You have plenty of margin of protection, even assuming considerable depreciation of transformer insulation with years of service.
3. You get excellent protection for your old transformers as well as for new ones.
4. You can expect the maximum life from your transformers.

NO NEED TO GAMBLE . . . ***Get the important extra margin of protection for your distribution transformers by specifying G-E pellet arresters. Select them from Bulletin GEA-2975. General Electric Company, Schenectady, N. Y.***

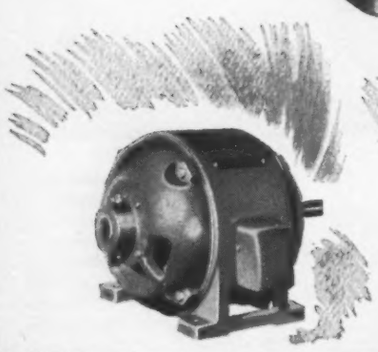
GENERAL ELECTRIC

TRI-CLAD protection

REG. U.S. PAT. OFF.

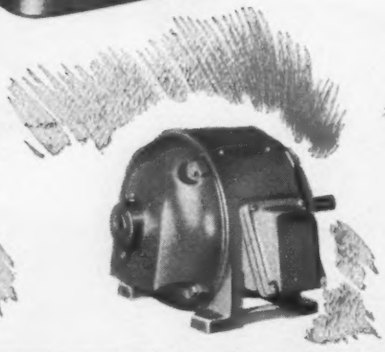
TRI-CLAD Sleeve-bearing Polyphase Industrial Motor Is Most Widely Used

A well-protected, open motor for industry's general-purpose needs. Horizontally mounted—for direct-connected and belt drives—it is economical to operate and suitable for a variety of applications.



TRI-CLAD Ball-bearing Polyphase Motor

Has additional advantage of being mountable in other than horizontal positions. Will take end thrust—for example, from beveled-gear pinion. Similar to the sleeve-bearing motor and, like it, available in many types.

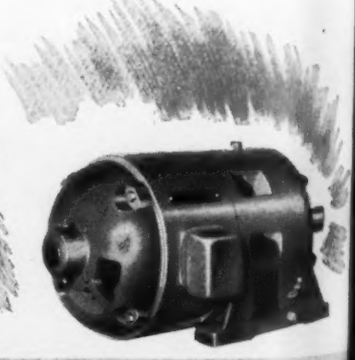


TRI-CLAD Splashproof Ball-bearing Polyphase Motor

For use in wet surroundings, such as dairies, breweries, paper mills, canning factories, etc. Furnished with cast-iron, waterproof conduit box, deflecting end shields, and moisture-resistant insulation.

TRI-CLAD Capacitor-Motor (in sleeve-bearing or ball-bearing types)

For single-phase operation. Available in types to drive such devices as compressors, pumps, fans, etc. No radio interference; no brushes to wear; quiet operation.

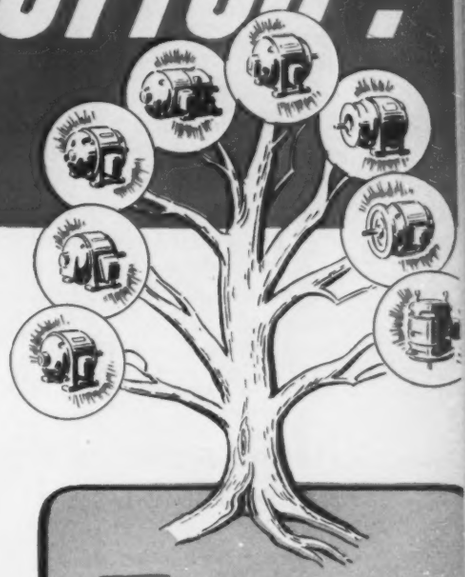


TRI-CLAD Gear-Motor

For economical, compact, low-speed direct or pinion drive. Wide range of output speeds available. Open, splashproof, and capacitor-motor construction. Oil- and dust-tight housings reduce maintenance.

Built for Protection First.....to Last!

is now a *family affair!*



THE improvements in Tri-Clad motor design are *fundamental* improvements, not just "sales features" to popularize a new model. That's why they are being extended, month by month, to a whole family of G-E integral-horsepower motors—both general-purpose and special types.

So, in these special fields you can now count on getting the same benefits of extra protection that have made the *general-purpose* Tri-Clad motor the acknowledged leader in performance and service life.

All these new members of the Tri-Clad family are the result of basic redesign to meet modern industrial conditions. Each has new performance and convenience features important to its particular field of service. For complete information on the right Tri-Clad motor for *your* application, consult our local office, or write General Electric Company, Schenectady, N. Y.

TRI-CLAD Ball-bearing Induction Motor, with Face-type End-shield Mounting
For close-coupled attachment to machine tools, compressors, pumps, etc. Motor bolted from driven machine. A few standard mounting dimensions apply to many motor ratings.

TRI-CLAD Round-frame, Ball-bearing Induction Motor, with Flange-type End-shield Mounting
For close-coupled attachment, or direct bolting to driven machine. Mounting dimensions are standard, but larger than those of face-type end shield.

TRI-CLAD Vertical Motor
For general-purpose fan, pump, and machine drives in vertical position. Openings protected and bearings designed for vertical operation. Both polyphase and capacitor-motors available with variety of bases.

Today a wider range of your special needs can be filled by the growing Tri-Clad motor family. Every member offers extra strength and longer life because of these 3 "extras":

Extra Protection
AGAINST PHYSICAL DAMAGE
Sturdy, cast-iron frame and end-shield construction.

Extra Protection
AGAINST ELECTRICAL BREAKDOWN
Stator windings of Formex wire, "armored" by synthetic resins against moisture, heat, oil, and abrasion.

Extra Protection
AGAINST OPERATING WEAR AND TEAR
New sleeve-bearing design and improved ball-bearing mounting lengthen life.

In addition, you'll find the modifications to meet special requirements are soundly engineered to give you space-saving, time-saving, and money-saving advantages all down the line. Consult your G-E representative for Tri-Clad horsepower ratings now available.

GENERAL ELECTRIC

750-90-8058

bulkhead and the position of the floating deflector it is possible to keep water temperature between 33 and 40 deg.

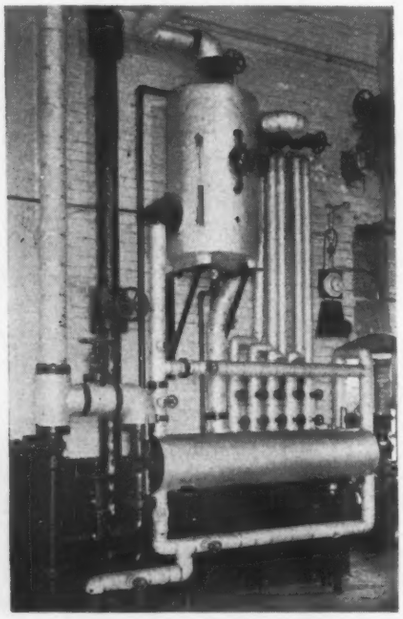
In winter months the higher condensate temperature resulting from recirculation benefits the station heat rate. It is estimated that condensate is 7 deg. higher than it would be if intake water was not controlled within the 33-40 degree range. Primary reason for the arrangement used, however, is to eliminate slush ice.

During summer months the plank bulkhead is removed and the surface deflector used to keep floating refuse away from the trash rack.

•

Heat Recovered From Boiler Blow-Down

By the installation of a flash-tank and heat-exchanger recovery system the heat of boiler water can be utilized in preheating the incoming boiler feed. In a typical plant generating 300,000 lb. of steam per hour 20,000 lb. of boiler blow-down is not uncommon. Blow-down water is flashed at 40 lb. per sq.in., producing 5,220 lb. of steam available for further work. The remainder of the boiler blow-off, 14,780 lb. per hour at 287 deg. F., is passed through a heat exchanger, raising the temperature of incoming feedwater to 80 deg. F. The blow-off water is exhausted to the sewer at less than 100 deg. F. Based on usual calculations for determining the heat savings, this installation is saving 8,584,400 B.t.u. every hour.



TYPICAL Cochrane heat-recovery system installation has flash tank above and heat exchanger below

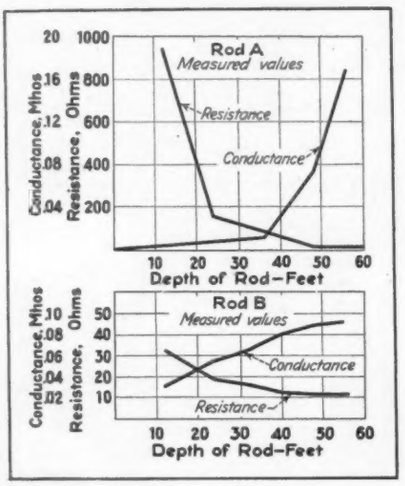
•

Ground Resistance Varies With Depth

By J. R. EATON*
Purdue University, Lafayette, Ind.

A great variation in soil resistivity is noted at different depths below the surface of the earth. These differences are accounted for by differences in composition of the soil in different layers, differences in the moisture content and differences in temperature.

On the accompanying curves illustrating differences of soil resistivity with depth the change in conductivity is best observed from the curves showing change in the conductance of the rods with depth. The slope of either conductance line at any point is an indication of the conductivity of the earth being penetrated at the lower end of the rod at that particular depth. Different soil strata are definitely indicated by the different observed slopes of the conductance curves.



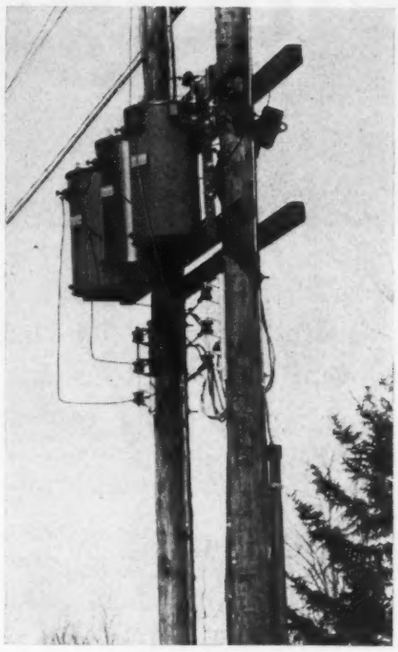
RESISTANCE and conductance of grounding rod vary with depth

Both curves apply to a ⅝-in. diameter rod; measurements of resistance were taken as each rod was driven deeper into the ground. (Curves refer to a "rod A" and a "rod B")

[Ed. Note—This is the fourth of a series of articles discussing various phases of grounding.]

*Consultant for James G. Biddle Co.

Economical Mount for Transformers



SECONDARY buses formed between pole brackets facilitate service tapping

A compact mounting of three 15-kva. transformers supplying power to radio broadcasting station WTAG from the distribution circuits of the Holden (Mass.) municipal lighting department was obtained by the method illustrated, in which the town's 2,400-volt, three-phase No. 6 primary taps are brought down a joint pole structure to cutouts at the rear, while the 230-volt, three-phase secondary connections are carried to No. 2 weatherproof horizontal bus wires supported between insulator brackets racked against the poles. The poles are 35-ft. Class 5 chestnuts, or Southern pine, and are set 7 ft. apart on centers, with the transformer bank about 12 ft. above the ground. Primary taps are No. 6 and the secondary feed into the radio station is of No. 1, carried about 300 ft. underground in Orangeburg fiber conduit, with a 2½-in. downtake conduit on the pole. Crystal valve type lightning arresters are located on an adjacent pole and the station lighting circuit supply is taken off from a 10-kva. transformer and run underground as a No. 4 three-wire, 120-volt service.

At the rear of the poles carrying the power transformers are two 8-pin crossarms bolted to the poles to stiffen the construction, and two similar

At any time, it is easy to check any L-M HEAVY-DUTY Lightning Arrester right on the line, without costly laboratory or field tests. You are always sure that your L-M Arresters are in perfect condition.

The double "elastic" seal keeps out moisture and prevents gap corrosion . . . no leakage to ground, no radio interference.

The special L-M valve material handles high-amperage and long-tail surges equally well and due to its characteristics, holds internal resistance (IZ drop) to low values at all surge currents.

The L-M valve material is chemically and electrically absolutely stable, does not change its characteristics in operation and assures the same unfailing operation even after years of performance.

An added feature, only found in L-M HEAVY-DUTY Arresters, is the ISOLATOR (Pat. Pending). Any arrester might become damaged at some time in service. The L-M ISOLATOR will then save you time and money because it will automatically cut off the faulty arrester from the line, preventing feeder lock-out or phase grounding.

Detailed information further explaining and illustrating the reasons why these features contribute to better service is covered in bulletin LMB-40151. Write for it to Line Material Company, Milwaukee, Wis.

LINE MATERIAL COMPANY

arms at the front carry the transformer hangers. On account of the weight of the middle transformer two angle-iron braces are provided and lagged to the poles. The transformer cases are grounded by a No. 4 conductor run down the pole to a combined ground of water piping and 8-ft. driven rods. By carrying nearly all the wiring on one side, climbing space has been freed for telephone and lighting department linemen.

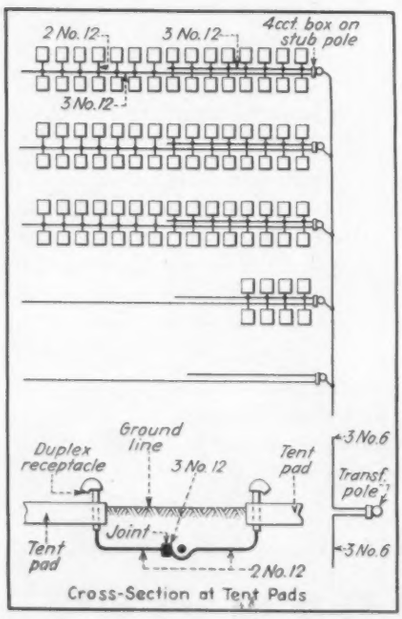
•

Underground Service for Tent Camp

By P. R. MILES
Holabird & Root,
Architects & Engineers, Chicago

Some 1,200 army tent pads of concrete poured in one operation were constructed at Camp Grant. A novel method of bringing electric service into these pads was used.

Near the back of the pad a 1½-in. hole is left in the concrete. A weatherhead mounted on a short length of pipe is inserted in this hole and cemented in. The weatherhead has a duplex receptacle into which are plugged extension cords for tent lamps, radios, etc. Behind the tent pads an 18-in. ditch is dug in which are carried two rubber-insulated three-conductor No. 12 direct-earth-burial cable branch feeders. Two rows of fifteen tents each are backed up together and one cable splice feeds two tents, each tent having a 50-watt lamp.



METHOD used for bringing service into tents in army camp

The splices are made by cutting open the cable, twisting the bare wire ends together, soldering and then taping. The taping is done as follows: First, the soldered joints and insulated ends of the cable are well taped, using ordinary rubber tape to the rubber insulation of the cable; the whole joint is then well covered with friction tape; finally, the whole joint is again covered with a self-vulcanizing 98 percent pure rubber, gum-faced tape. This makes a waterproof joint, which is buried directly in the ground.

A four-circuit weatherproof switch box, fed and tapped by underground risers, mounted on a short pole at the head of the line of tents, fuses the four circuits. A three-conductor No. 6 main feeder of the same type as the branch feeder runs underground along the end of the lines of pads and is carried back to a main fuse box at the transformer pole.

This system provides a neat and relatively inexpensive method of electric distribution which seems to be very well adapted to the purpose for which installed.

•

Live Line Tool Operations Studied

To determine the diversity of operations and number of jobs performed on energized lines with live line tools, the operating department of Pacific Gas & Electric Company had line foremen report individual jobs for a period of three months. During that time 29,591 jobs classified into fifteen different operations were recorded. Purpose of the study was to determine whether increased investment in these tools was justified.

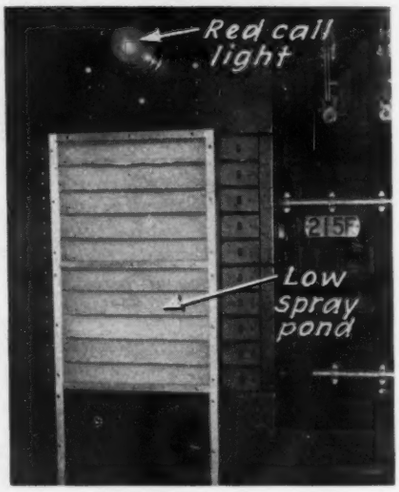
Types and number of jobs reported for the last quarter of 1940 for all divisions of the company except San Francisco and East Bay were:

Line tap jumpers installed	7,729
Line tap jumpers removed	6,098
Poles set in line	568
Poles removed from line	411
Damaged insulators replaced	1,157
Damaged insulator pins replaced	2,487
Damaged crossarms replaced	165
Pole top switches installed	7
Pole top switches tested	147
Pole switch insulators tested	5,856
Insulators cleaned	865
Conductor vibration clamps tightened	3,588
Conductor vibration dampers installed	240
Pole top risers installed	47
Miscellaneous and unclassified operations	226
Total operations	29,591

Voltages worked ranged from 2,300 to 220,000. It was discovered that availability of tools to line crews permitted many minor jobs to be performed almost automatically.

•

Annunciator Board Shows Plant Troubles

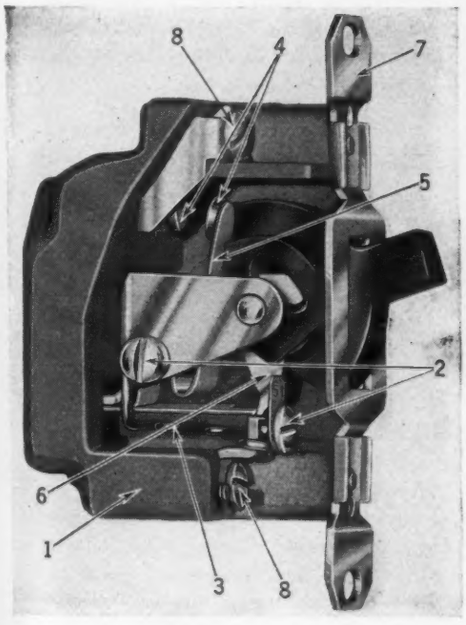


ANNUNCIATOR board at Cheyenne, Wyo., plant spots trouble quickly

A plant trouble annunciator board having notable flexibility features has recently been added to the switchboard at the Cheyenne, Wyo., plant of the Cheyenne Light, Fuel & Power Company. The board gives the operator indication of the type and location of such plant troubles as low steam pressure, low feedwater pressure, low turbine bearing oil pressure, low spray pond, high lubricating oil temperature, etc. At present the board indicates ten trouble sources, but provision is made for increasing this to 25 in the future.

Several adaptations of the Mercoid tilt tube are used as the trouble-detecting element. These tubes operate 110-volt relays at the annunciator panel, lighting up one of several strips of frosted glass which is lettered to indicate the type of trouble existing. Concurrently, a red light flashes at the top of the pond to call the operator's attention. Toggle switches are provided at the right side of each glass strip which permit the operator to hold the indication until he can take care of it. Operation of the toggle switch at the same time releases the balance of the board for other indications which may come in the meantime.

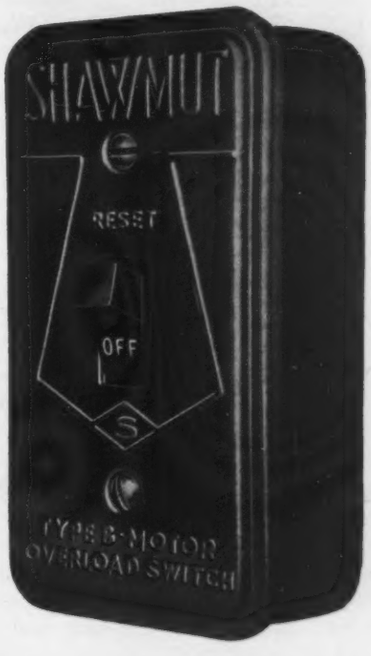
TAKE A LETTER



to everybody who uses overload switches, about the many advantages of the

SHAWMUT TYPE B MOTOR OVERLOAD SWITCH

A manually operated auxiliary circuit breaker with on and off switching, for use with fractional horsepower motors. Compact, sturdy, simple; positive overload protection; long mechanical and electrical life; easy to install, ample wiring space, no delicate or flimsy wound springs that might be liable to break, all metal parts rust-resisting.



For air conditioning apparatus, refrigerators, washing machines, fans and blowers, pumps and compressors, floor polishers, oil burners, saws, stokers, small grinders, small printing presses, small conveyors, machine tools and similar motor-driven equipment.

Maximum rating single and double pole 1 h.p. 115-230 volts A.C. Two types, open and enclosed; open type fits all standard boxes and cover plates. Exclusive patented features, other patents pending. Ask your dealer or write for our Bulletin 406.

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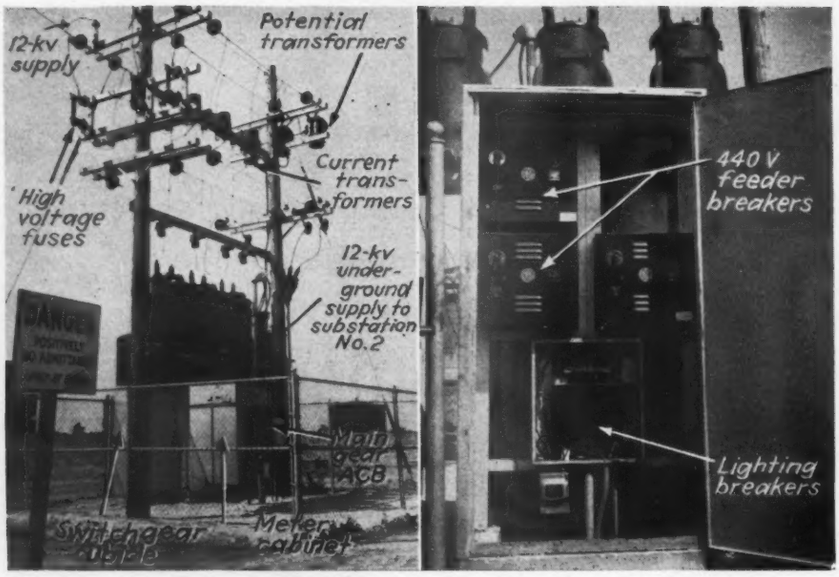
NEWBURYPORT, MASSACHUSETTS

MAKERS OF ELECTRICAL PROTECTIVE EQUIPMENT SINCE 1893

INDUSTRIAL ENGINEERING



COMPACT refinery substation (left) makes effective use of factory-assembled switchgear (right)

Compact Substation For Oil Refinery

Effective use has been made of both space and modern factory-assembled switchgear in designing the two 150-kva. substations supplying the new refinery of the Wisconsin Oil Refining Company, Sheboygan. Each of the refinery's two substations is supplied from the four-wire, 6,900/1,200-volt, grounded neutral system of the Wisconsin Power & Light Company, and each substation contains a bank of three 50-kva., wye-delta-connected, 6,900/440-volt transformers and a 15-kva., 6,900/110/220-volt lighting transformer.

With the exception of the main 440-volt, 600-amp. air circuit breaker within each substation inclosure, secondary branch feeder air breakers at each location are housed in switchgear inclosures accessible to plant operators from outside the substation inclosure, as shown.

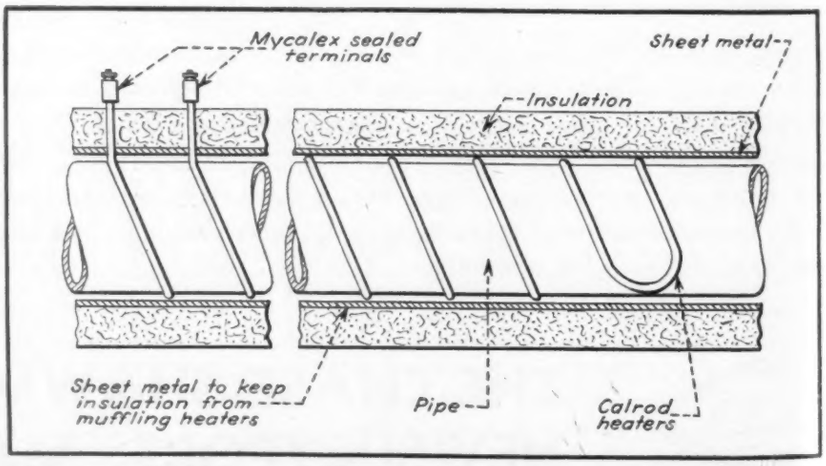
All metering equipment and instrument transformers are located at No. 1 substation at the point where service connection is made. It is also to be noted that supply to No. 2 substation is via an underground 15,000-volt cable from No. 1 substation, where fused disconnect switches provide means for disconnection in case of trouble.

•

Electric Heat for Asphalt Pipe Line

By R. W. KISE
Industrial Heating Section Industrial Department, General Electric Company, Schenectady, N. Y.

Thermostatically controlled "Calrod" heaters, bent into hairpin shape and spiraled on approximately a 2½-ft. pitch throughout the 600-ft. length of the unloading pipe, keeps asphalt free-flowing at 350 deg. F. on its journey from tank cars to two stills at the Byerlite Corporation, Cleveland, Ohio, and furnishes a guide to



ELECTRIC HEATERS applied to unloading pipe line keep asphalt free-flowing at 350 deg. F. Standard heating units bent into hairpin shape are spiraled around pipe

★ ★

It's hard to say "No" to a friend...

WE at Revere have always felt that we have, not "customers", but friends. Certainly, this has been our way of looking at it, because we have thought of your order not only as so many pounds or tons of metal—but as a valuable opportunity for us to make you feel glad you came to Revere for copper or copper alloys.

That's why we haven't had much use for the word "No"—up to the time of priorities and preference ratings. But Uncle Sam has the final word in this emergency, and now we sometimes find ourselves unable to oblige even our oldest and best friends.

Revere Technical Advisory Service will, however, continue to work closely with you, bringing to bear on your problems all of Revere's extensive knowledge of materials. In some cases we have been able to guide our customers into Defense contracts in which priorities work for them instead of tying their hands. So get in touch with Revere—together we may find a way of changing "No" to "Yes".

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applications of a similar nature.

To assure uniform temperature to the pipe line and prevent hot spots, sheet metal—in sheets 2½ ft. long—was formed around the pipe line and the heaters, leaving a space between the metal sheet and the pipe. To prevent the entrance of moisture the heaters were equipped with "Mycalex"-sealed terminals which extend out through the insulation and were wrapped with asbestos tape and rubber tape and painted with "Glyptal" insulating varnish for further protection from the weather. Series-parallel connection of the heaters provided flexibility.

For this application a heating installation was needed which would supply the radiation losses and maintain the 350-deg. temperature necessary to keep the asphalt free-flowing, in order to cut down unloading time and increase production. It was also essential to keep moisture out of the unloading line, since such moisture would flash into steam on reaching the stills operated at approximately 500 deg. F., causing the still to bubble over, clogging the exhaust condensers and possibly throwing asphalt out of the top of the vent stacks. Electric heat accomplished these results and provided a job that is low in maintenance and economically operated, at an initial cost lower than a steam-jacketed line.

The pipes of the circulating system between the stills are kept at approximately 500 deg. F. by other similar "Calrod" heaters, also thermostatically controlled. Pump casings are similarly heated.

The electric heating load for this application totaled 10 kw. Generally speaking, the following rule-of-thumb may be used to calculate the energy required:

When the pipe line is insulated with 1 in. of good insulation, use 0.25 watts per sq.ft. of pipe surface per degree F. temperature difference between desired pipe line temperature and surrounding air temperature.

•

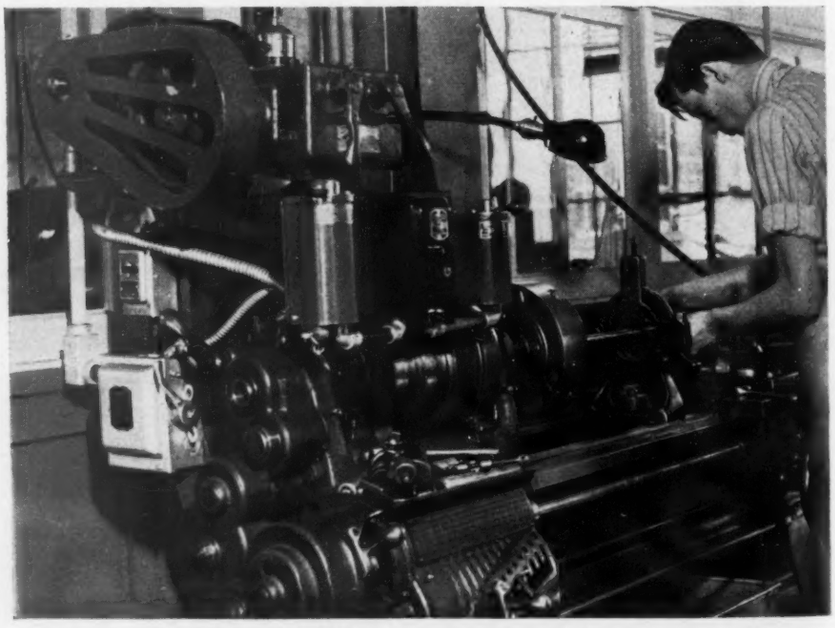
Photograph Credit

Inadvertently, the credit lines were omitted from the pictures of the Bell Aircraft Corporation which appeared on page 86 of ELECTRICAL WORLD for August 23, 1941. Credit lines should have read: The Austin Company, Engineers and Builders.

First Large-Scale Application of Sterilamps in an Industrial Plant

By the use of 104 Sterilamps bactericidal ultra-violet has been applied to the air-conditioning system in the plant of Bristol-Myers Company, Hillside, N. J. All air passing through the air ducts at the rate of 40,000 cfm. is rendered 95 percent free of air-borne bacteria. The 30 in. lamps are mounted vertically, 1 ft. apart, in rows 15 in. apart, in a special chamber. Each of these Westinghouse lamps is operated at 475 volts and 0.04 amp. Power is obtained from a current-regulating transformer having an open circuit voltage of 3,000 volts and supplying four lamps in series. For the 104 lamps 26 transformers are required.

Two-Speed Motors Give Better Lathe Operation



Toolroom lathes recently modernized and converted to individual drive at the Springfield, Ill., plant of the Sangamo Electric Company have been fitted with two-speed motors, V-belted to a multi-speed gear reducer that drives the lathe cone through a flat belt. The two-speed motor reduces the gap between high speed (with back gears in) and low speed (with back gears out), thus giving better over-all performance. A reversing switch in the motor circuit provides forward and reverse spindle drive and is used to give quick stop.

Here are good reasons for using "ROME 60"

for portable jumper cables, meter test leads, and portable tools.

It is an outstanding rubber sheathed cord for heavy duty.

It is pliable, will stand sharp jerks and pulls. And because the tough 60% rubber jacket of our special compound is vulcanized in continuous lead moulds, it is highly resistant to abrasion, tearing, and the deteriorating influence of heat, light, oils, acids, and moisture.

"ROME 60"

is a good cord for every portable use.

Write for detailed description and price sheets.

ROME CABLE CORPORATION

ROME, NEW YORK

SALES OFFICES

NEW YORK CHICAGO CLEVELAND
PITTSBURGH DETROIT LOS ANGELES
RICHMOND PHILADELPHIA BOSTON

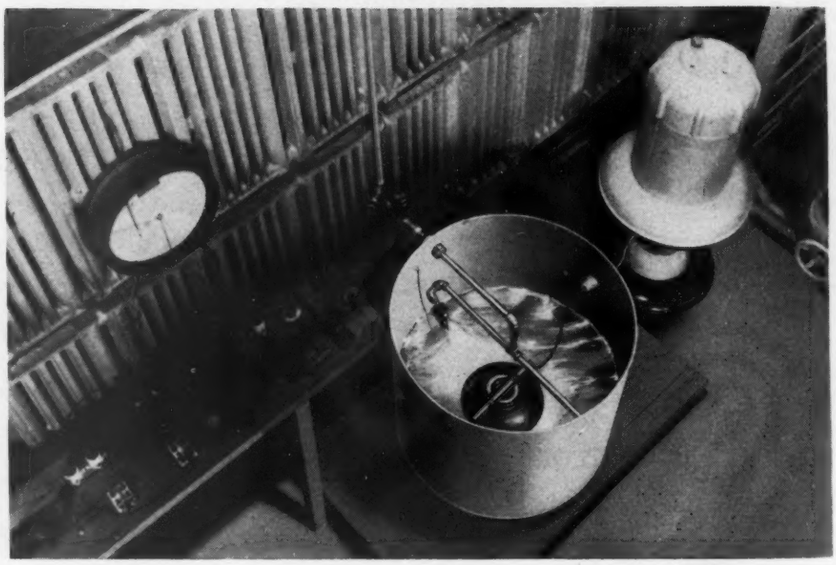
Hot Rolled Copper Rods * Bare and Tinned Strand * URC Weatherproof Wire
Bare and Tinned Copper Wire * Rubber Insulated Wires and Cords
Lead Covered Cables * Cotton, Paper and Asbestos Magnet Wire * Rome 60
Multiconductor Power Cables * Network, Service Entrance, Control Cables

NEW ENGINEERING IDEAS

Electronic Control for Leakage Current Tests

CHARLES J. MILLER, Jr.
Electrical Engineer
Ohio Brass Company, Barberton

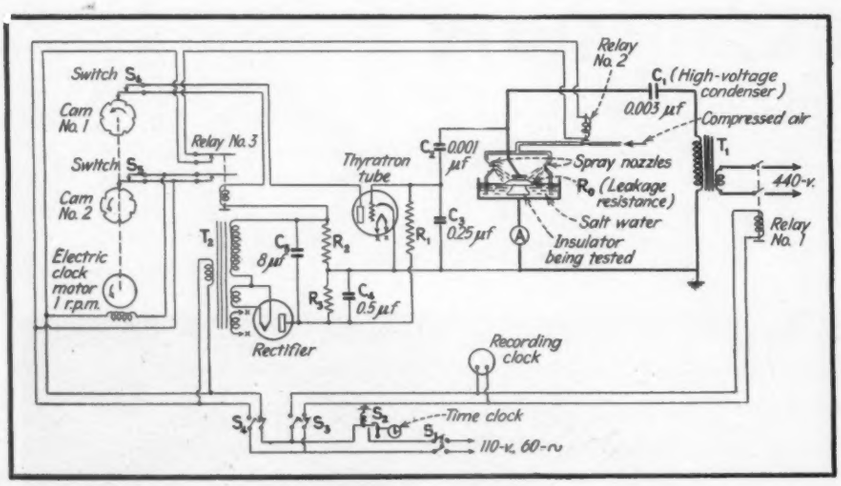
During the development of conduction glaze for radio-free pintype insulators it became desirable to study the results of long exposure to high leakage currents. Several methods were tried before a satisfactory means was discovered for maintaining a surface leakage current continuously. An accompanying illustration shows the control connections for the test equipment.



LEAKAGE CURRENT testing equipment, showing control apparatus (left), tank with immersed insulator (center) and high-voltage condenser (right)

The insulator to be tested is immersed in salt water to the edge of the top shell. Compressed air, controlled by a thyratron tube, provides an atomized spray which periodically renews the conductivity of the surface coating. A high-voltage condenser C_1 limits the current to about 50 milliamperes when the leakage resistance R_o is small. A capacitance potential divider, C_2 and C_3, in parallel with the insulator impresses a 60-cycle voltage on the grid of the thyratron tube. D.c. plate voltage and grid bias are provided by a simple rectifier.

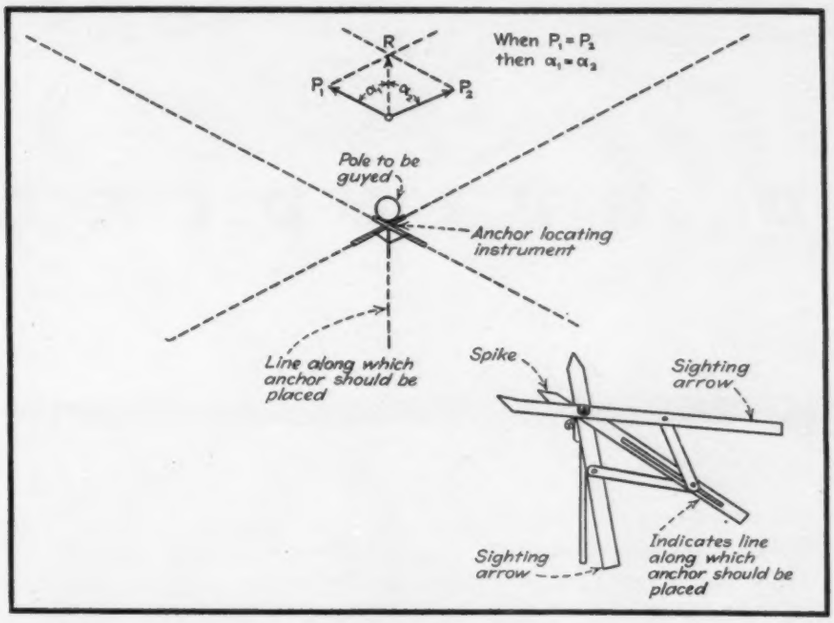
The sequence of operation is as follows: The leakage current, which is essentially constant because the impedance of C_1 is several times as large as R_o, causes the surface film to evaporate, thereby increasing its resistance and the voltage across the insulator. This voltage increase causes the thyratron tube to fire when the positive crest of the 60-cycle wave exceeds the negative d.c. bias. Firing of the tube releases the spray through the operation of relays No. 3 and No. 2, and the conductivity of the surface coating is restored.



CONTROL CIRCUIT for leakage current testing equipment

Because the thyratron grid loses control once the tube fires, it is necessary to provide an additional control circuit which limits the duration of the spray and resets the circuit for the next operation. This is accomplished by two cam-controlled switches, S_5 and S_6, driven by an electric clock motor.

When the thyratron fires, closing relay No. 3, the motor starts and turns both cams at 1 r.p.m. This operation closes switch S_5, which permits the



INSTRUMENT determines "best" anchor location for corner pole by bisecting exterior angle formed by it and its adjacent poles

motor to run to the next notch on cam No. 2, regardless of the position of relay No. 3. When the first notch of cam No. 1 is reached the plate circuit is broken by switch S_6, releasing relay No. 3 and stopping the spray. Because the a.c. grid voltage has been reduced below the firing point as a result of the spray, reclosure of switch S_6 does not refire the tube. The duration of the spray period is controlled by the relative position of the two cams.

Clocks for recording time on test and for shutting off the entire circuit are provided.

•

Instrument Guides Anchor Location

To determine the optimum location of guy anchors for corner poles W. C. Dillon & Company, Chicago, has devised a field instrument known as the "bisector," which is based on the premise that the correct anchor location is along a line bisecting the exterior angle formed by the corner pole and its two adjacent poles. Such a premise must assume that the angular forces exerted by the line conductors on the corner pole in the horizontal plane are approximately equal and that only one guy is to be installed to balance these forces. Under these conditions the diagonal of the parallellogram of forces acting on the pole in a horizontal plane will bisect the angle between the forces and the anchor would properly be located in the vertical plane through the complement of this resultant force.

The accompanying sketch illustrates the principle upon which the device operates and how it is used.

To locate the anchor for a pole that has already been set, the spike on the instrument is thrust into the pole to be guyed and each of the instruments' two "arrows" are set individually by sighting along them to the two adjacent poles. The third element of the device, which is loosely coupled to each of the arrows by links of equal length, then indicates the line along which the anchor should be set. To locate an anchor while the line is being surveyed the instrument may be set on a spike beside the survey stake at the guyed pole location and arrows "sighted in" on survey stakes in both directions.

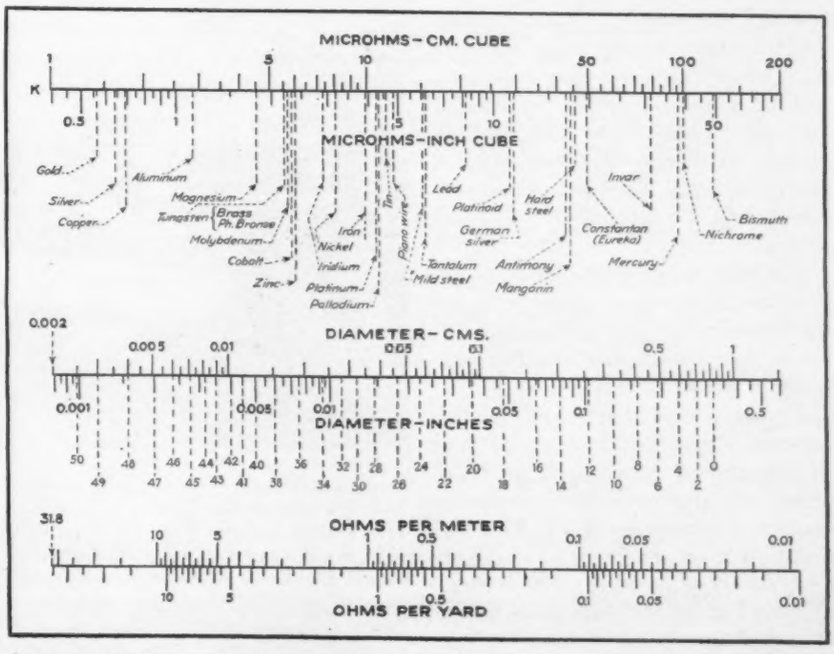
•

Nomogram Evaluates Resistance of Wire

By D. J. WILLIAMS
Birkenhead Institute, England

Resistance of a unit length of round wire of any gage and of practically any material at a stated temperature may be determined by the use of the accompanying nomogram. A straight edge placed at known values on scales K and d will indicate the resistance in ohms on the scale R.

The nomogram is based on the formula $R = Kl/a$, where R is resistance in ohms, K is resistivity in ohms per cubic meter, l is the length in centimeters and a is the cross-sectional area in square centimeters. For a round wire and to give resistance of one meter of wire, a becomes $0.7854\ d^2$, where d is the diameter, l is 100 centimeters and, if the resistivity is measured in microohms, the formula is $R = K/7854d^2$.



RESISTANCE of round wire evaluated

LOAD BUILDING

All-Out Campaign Boosts Farm Use

Proof that a short, intense sales campaign can effectively bolster temporarily sagging rural consumption comes from the territory of an Illinois utility company. Here in one month the company's entire sales force of 22 men working with dealers concentrated on 11,000 rural customers scattered over 4,500 square miles of territory and added 582 major appliances to company lines.

History behind the campaign is interesting. This Illinois company has for the last five years been adding rural customers at a rapid rate (1,500 per year). As is usually the case, newer customers used somewhat less energy (75 kw.-hr. per month) than those who had been on the lines for more than a year (125 kw.-hr. per month). Because of this fact, and because customers were being added at such a rapid rate, company executives noticed a slowing up in the rate of increase of rural use and later an actual, but slight, decrease. Apparently, the rapid increase in customers was having a diluting effect on rural load growth.

The campaign was conceived to relieve the situation, to regain an average consumption per customer of 125 kw.-hr. per month and establish momentum for an increase.

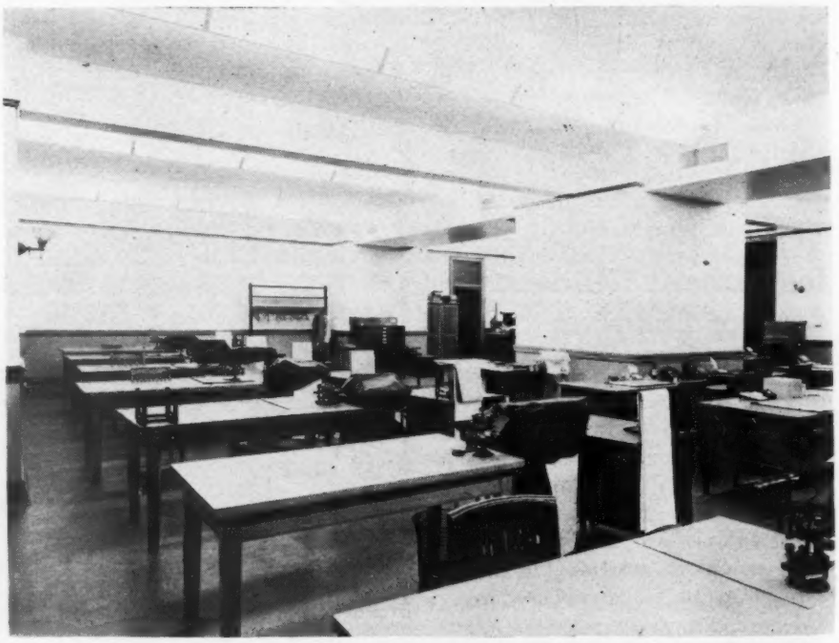
To bring this about, each of the company's staff of 22 salesmen, (ten of whom had never sold in rural areas) was given a list of customers to contact. Coupons good for $10 discount each on the price of a range, water heater or pressure water system, or all three, were made available to rural customers who purchased during the campaign. Bonuses were set up for salesmen turning in "leads" which resulted in sales by dealers. In all, dealers sold 198 water system installations, 25 ranges, 14 water heaters.

Company salesmen sold 186 ranges and 146 water heaters, a total of 332 units, or an average of more than fifteen each. The quota was exceeded by two. Thirteen refrigerators were also sold by the salesmen.

When the smoke cleared away salesmen had called on two-thirds of the 11,000 customers and reports for subsequent months on average rural consumption showed that the objective of 125 kw.-hr. per customer per month had been attained and exceeded slightly. As a by-product of the activity, the company gained a list of active prospects for ranges, water heaters and refrigerators that is now being actively cultivated.

• • •

Utility Office Lighted to 50 Ft.-Candles



Going on the rule that the utility should not be slow in buying what it sells, the Public Service Electric & Gas Company has recently modernized the lighting on three floors of its general office building in Newark to 50-ft.-candle levels. Avoiding special designs, the company installed commercially available fixtures, the same as are sold to its customers. In this picture are shown Barkon-Frink semi-direct 4-ft. luminaires mounted end to end, each equipped with four 40-watt fluorescent white lamps connected in pairs with "Tulamp" ballasts. Ceilings are 11 ft. 6 in. and spacings between rows of luminaires are 14 ft. in the larger offices and 9 ft. in the smaller. On the two floors where these particular units are used 401 luminaires containing 1,604 lamps are installed.

Outstanding Systems Depend on DE LAVAL INSULATING OIL PURIFIERS for ECONOMICAL PROTECTION OF EQUIPMENT

EFFICIENT, economical maintenance of insulating oil is assured at high capacity . . . with continuous water discharge . . . in a single pass . . . and at low, non-carbonizing temperature with De Laval Insulating Oil Purifiers.

Fully portable and semi-portable units operate at constant high efficiency during long runs. Continuous water discharge prevents contamination of purified oil by slugs of water. Automatic oil flow control and thermostatic heat regulation contribute to making these units virtually fool-proof in operation.

All insulating oil is completely freed of moisture without the aid of a blotter press. However, a press is available as part of the equipment to remove colloidal carbon from circuit breaker oil. When so used, the press handles only moisture-free oil, so that frequent and expensive changes of press paper are avoided and the cost of purification is reduced.

De Laval Insulating Oil Purifiers are insuring the delivery of oil of high dielectric strength at minimum expense for many of the nation's leading utility companies, and our engineers will gladly cooperate with you in similarly solving your problems of insulating oil maintenance.

Detailed information on the De Laval System is available in Bulletin No. 107. Write for a copy.

THE DE LAVAL SEPARATOR COMPANY

165 Broadway, New York 427 Randolph St., Chicago
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal Peterborough Winnipeg Vancouver

DE LAVAL INSULATING OIL PURIFIERS

Economically Protect Oil-Insulated Equipment

Apple Storage Uses Long-Hour Service

Long-hour consumption of energy between early fall and summer features the use of central station service by Nashoba Cold Storage, Ayer, Mass., which operates an apple receiving, holding and delivery plant with a capacity of 150,000 bushels. The plant is served by the Wachusett Electric Company, a New England Power subsidiary, and is equipped with two Frick refrigerating compressor units and several auxiliary motor-driven pieces of apparatus having an aggregate connected load of 132 hp. and a connected lighting load of about 7 kw.

There are two apple escalators, each driven by a 2-hp. motor and five 26-in. fans, each driven by a 1/3-hp. motor. The escalators are capable of handling 500 bushel boxes per hour each. A 5-hp. pump is also in use, with a capacity of 240 g.p.m. One compressor (24 tons) requires a 50-hp. and the other (36 tons) a 75-hp. motor, V-belt drives being used. In general, 550-volt, three-phase induction motor drives are employed.

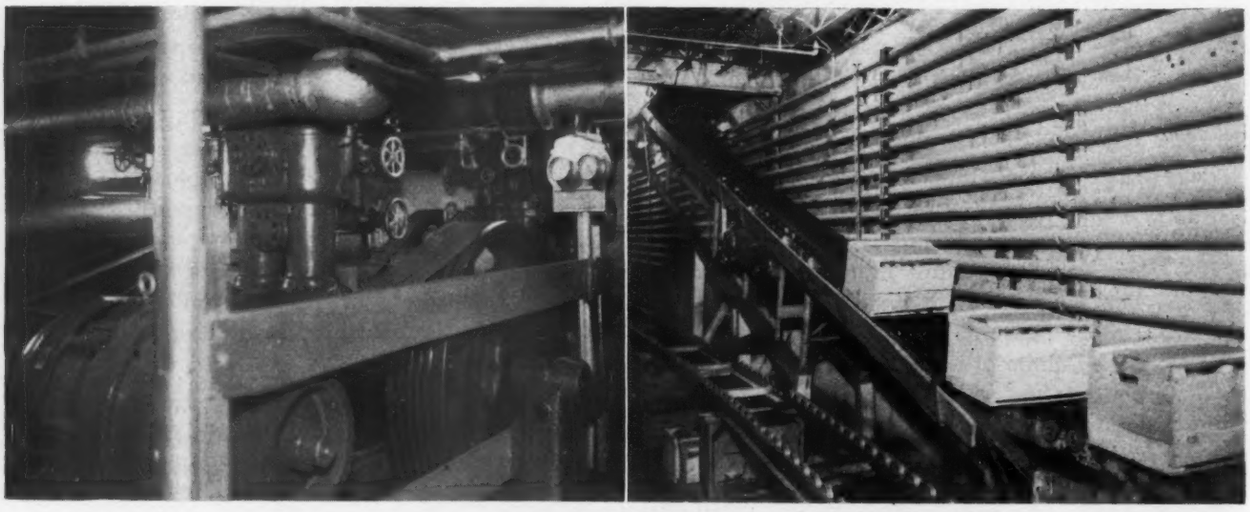
The building is two and three stories in height and is insulated by 6-in. hollow tile and 3 in. of cork. Temperatures are maintained at about 32 deg. F. or 4 deg. above the freezing point of the fruit. As continuous attendance is required, temperature readings are taken every two hours and manual adjustment of the fan and air supply system and compressor service is maintained.

The energy consumption depends considerably upon the seasonal weather conditions and use of outside air to facilitate cooling. The maximum demand in October, 1940, was 99.5 kw. and the total energy consumption in kw.-hr. by years from 1936 on has been 160,400, 135,400, 193,600, 153,000 and 152,260. A great advantage of such storage is the ability it gives the operator to maintain quality of fruit through the late winter and spring by controlled temperature conditions, thus contributing toward a better market for the apples stored. T. A. Hamilton is plant manager.

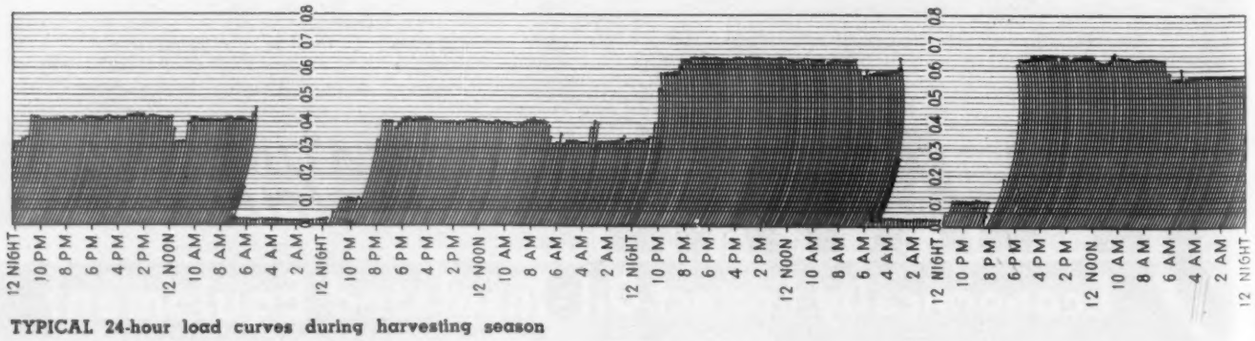
Stairway Sales Appeal

Eames Studio, Manchester

Public Service Company of New Hampshire features better home lighting by this effective display at its main offices in Manchester, utilizing a stairway from the first to second floors for exhibit and demonstration of I.E.S. units and making even the wall space tell a sales story with compelling logic.



TWO motor-driven refrigerating units provide flexible service (left) Electrically run conveyor system moves boxed apples up or down (right); two units can handle 500 bushel boxes per hour each



TYPICAL 24-hour load curves during harvesting season

Control Cables NEED Not BE BULKY

Size is no indication of quality nor is it a basis on which to judge control cables. The quality of control cables depends on the electrical and physical properties of the rubber insulation.

LATOX insulation is 90% grainless, unmilled rubber. Ordinary rubber insulation for the same service has only 30% rubber. For that reason a thin layer of LATOX insulation is equivalent to many times its size of 30% rubber insulation. This follows, naturally, because of the much higher electrical and physical qualities of LATOX insulation compared with ordinary rubber.

Simplex-LATOX insulated cables are from one-half to two-thirds as large as cables for the same service. LATOX cables can be small and still be dependable because of the thin wall of high-grade rubber insulation around each conductor.

Other reasons why LATOX insulation is thinner and just as dependable are given in the new LATOX book — it will be sent to you upon request.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

SIMPLEX WIRES CABLES

NEW EQUIPMENT

Air Circuit Breaker

Designed especially for use in industrial, central station, or power plants where operation under repetitive duty cycles is required, new air circuit breakers are equipped with a rotary type, removable operating handle for controlling the breaker manually. In addition electric operation can be provided by a motor mechanism and a shunt trip. Main contacts are of silver alloy. These breakers are available in open and inclosed forms.

Type "DK" De-ion air circuit breaker; interrupting capacities 15,000 and 25,000 amp., ratings 15 to 600 amp., for operation on one, two-, three- or four-pole 600-volt a.c. or 250-volt d.c. circuits. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

•

Bond Tester

For measurement of a small fraction of an ohm, such as at contacts of switches and busbars, rail bonds, as well as measurement comparison of motor armature resistance, and testing effectiveness of electric bonds on airplanes and other vehicles, a self-contained portable electric bond tester is made available in pistol and meter models. Each tester has a dry-cell for source of current and is furnished with exploring probes, indicating meter and control equipment, and cable with clamp. Measured resistance is read directly from the meter scale.

Model "Aero-Gun" (illustrated) and "Milli-Ohm-Meter" electric bond tester, full scale ranges from 0.001 to 4.0 ohms; accuracy, plus and minus 3 percent and 2 percent, respectively. **Shallcross Mfg. Co.**, Collingdale, Pa.

•

Soldering Tool

New design of soldering tool has heating element which, when connected in series, it is said, furnishes sufficient heat for normal soldering purposes, and when elements are connected in parallel, increases the heat for heavier or faster soldering operations.

Soldering tool with heat control; 110-120 volts, a.c. or d.c. Size No. 1, 60 watts normal heat, 240 watts fast heat; size No. 2, 150 watts normal heat, 600 watts fast heat. **McKinley-Mockenhaupt Co.**, 626 West Jackson Blvd., Chicago, Ill.

Element connections are changed by a push button switch in the handle. Various sizes of copper tips can be accommodated.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Balancing Machine

Portable dynamic balancing machine is designed for checking unbalance of turbines, generators, or both rotating elements. Balancing equipment consists of three principal parts—a sine wave alternator, a vibration velocity unit and an indicating unit and its associated circuits—all fitted in a handy carrying case.

Portable dynamic balancing equipment. **General Electric Co.**, Schenectady, N. Y.

•

Electronic Rectifiers

Electronic industrial rectifiers; ratings ¼ to 500 hp., constant and adjustable voltage, d.c., for operation on 115, 230 and 440 volts, single and three-phase circuits. **Clark Laboratories**, Palm Springs, Calif.

New line of industrial rectifiers are suitable for machine tool manufacturers, central stations and for marine use. Some units have adjustable d.c. voltages from zero to maximum without loss of power through resistance, while maintaining a desirable wave form which does not interfere with proper commutation of d.c. motors up to 500 hp., it is claimed. These units also have electronic tube overload protection.

•

Gap-Link

Lightning surge currents can be safely by-passed without interrupting service, it is claimed, by using an improved gap-link in

Grand Champion

A "Grand Champion" horse in the highly trained gaited classes has won his place through proficiency in two general classifications—conformation and performance. We all know about "performance" whether it concerns horses or Pole Line Hardware, but conformation is something vastly different, though closely related.

With horses it is the shape of the head, the contour of body and legs, the placement and carriage of ears, mane and tail. A horse is *born* with it or without it. In hardware it is "design", and must be *put into* the article by someone who *knows*.

Hubbard 4-11-44 Wireholders have "clicked with judges" all over the world. Their design has been approved, tested and checked by "performance" for many years and under all conditions.

If you have not yet used the BLUE RIBBON 4-11-44 Hubbard Wireholder, you are in for a pleasant surprise. Write for a sample to look over and test—and "judge" for yourself.

HUBBARD AND COMPANY
PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

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CABLES

For Light and Power

Permitting Use Up to 75° C.

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NOW more economical to use due to higher permissible current carrying capacity.

ENDURITE INSULATION'S superior heat resisting and high dielectric characteristics make it specially suitable for use when electrical conductors are required to meet abnormal temperature and aging conditions.

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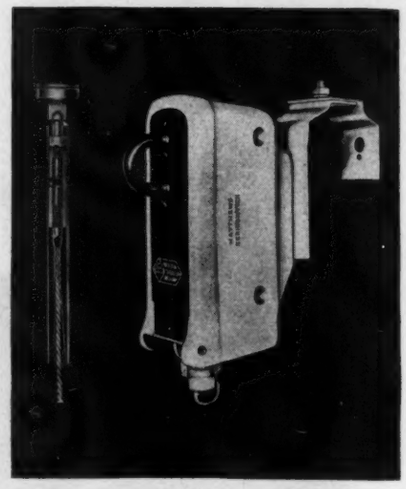
CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE

CRESCENT ENDURITE SUPER • AGING INSULATION



Cat. "GL-350" gap-link; voltage breakdown ratings, range from 750 to 5,300 volts; used with Cat. 350 Serieswitch, rated 7½ amp., 5,000 open circuit volts. **W. N. Matthews Corp.**, St. Louis, Mo.

the company's "Serieswitch." Since all internal fusible elements have been eliminated, it is not necessary for the circuit current to melt any part of the gap-link in order to operate the Serieswitch and disconnect the series lighting circuit loop when a fault occurs. Also an external fusible element has been added for the purpose of preventing an arc from forming between breaking contacts, in the Serieswitch, when the door of the switch is closed.

•

A.C. Tachometer

Type "A-80" a.c. tachometer; operating range from 0 to 5,000 r.p.m.; over-all accuracy ½ percent of full scale. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

A tachometer consisting of an a.c. generator and a voltmeter of the rectifier type has been announced for use with rotating equipment. No brushes or commutator are used in the generator, which is of the permanent magnet, a.c. inductor type. Alternating voltage is rectified by a Rectox unit in the voltmeter which can be calibrated in revolutions per minute, feet per hour, gallons per minute, or other units depending on the application. Best generator speed is 1,000 r.p.m.

•

Terminal Lug

Designed to take a wide range of wire and cable sizes, a recently developed terminal lug is said to have a positive and permanent grip on the conductor, by a self-locking action. It has no loose parts and can be reused as often as desired. Tongues are of any required size and drilling, straight or angle.

Type "E-Z" terminal lug; single and multiple posts; six sizes for conductors from No. 8 solid to 1,000,000 cm. **Penn-Union Electric Corp.**, Erie, Pa.

At Right: Grand Tower Power Station of Central Illinois Public Service Company—a credit to the engineers who designed it.

Below: Partial view of the 640 a.h. capacity Exide-Chloride Battery used for circuit breaker operation and emergency lighting.

YOU USUALLY FIND EXIDE SWITCHING BATTERIES IN PLANTS SUCH AS THIS

FOR nearly half a century Exide - Chloride Batteries have enjoyed the confidence of engineers all over the country. It is not surprising, therefore, that in most of the nation's best-equipped power plants these batteries are being used for a variety of stationary services.

Such a plant is the 50,000 k.w. Grand Tower Steam Generating Station of the Central Illinois Public Service Company. This very modern power plant — the output of which goes almost wholly to the coal mining industry of Egypt, Illinois, and its environs—depends upon a 60-cell Exide - Chloride Battery for the automatic operation of its many oil circuit breakers and for emergency lighting within the plant.

When you need a storage battery of real dependability, exceptional life, and low maintenance cost, we suggest consideration of the Exide-Chloride. Write for information about its Manchester positive and Box negative plates — so different from other plates — and the effect they have upon the battery's performance records.

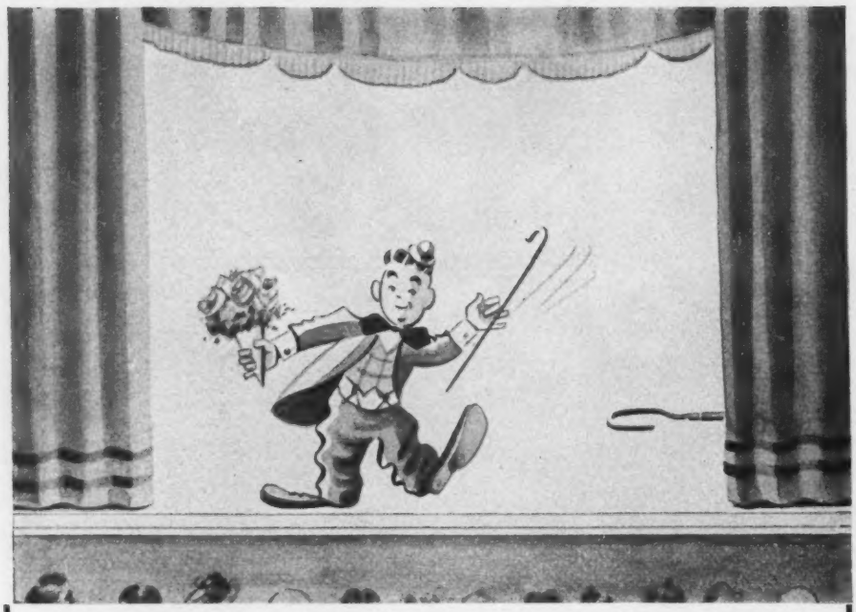
Exide CHLORIDE BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY

The World's Largest Manufacturers of Storage Batteries for Every Purpose

PHILADELPHIA

Exide Batteries of Canada, Limited, Toronto



Continental-Diamond *is no Tyro in this PLASTICS age*

The progress of man has been "mile-stoned" by the utility of the materials that he has put to work for his advancement.

Stone •
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Steel •
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C-D research technicians have in recent years replaced many weighty, corrosive, costly or hard to get metals with *Celoron* Molded Fabric Plastics. Experts often said, "It can't be done" . . . but, C-D did it!

Molded Fabric *Celoron* . . . is 1/6 the weight of brass . . . 1/5 the weight of cast iron . . . 1/2 the weight of Aluminum. *Celoron,* for all practical purposes . . . is chemically inert, insoluble, and infusible . . . it is little affected by moderate concentrations of sulphuric, hydrochloric, and such acids. Sudden changes of temperature have practically no effect . . . it will withstand up to 290° F.

Put your "What Material?" problem up to C-D experienced research technicians

Send for this booklet!

. . . includes a ready reference chart showing best type of electrical insulating material to use for specific problems . . . gives complete data on standard sizes, forms, colors and finishes of C-D Insulating Materials . . . *Ask for folder GF-12.*

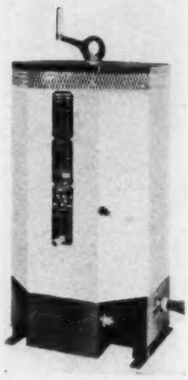
Continental-Diamond FIBRE COMPANY

"Manufacturers of Laminated Plastics Since 1911"

NEWARK • DELAWARE

A.C. Welders

New line of a.c. transformer welders are self-contained units for heavy arc-welding applications as in shipyards, railroads and steel mills. Continuous stepless current regulation is provided over the entire range by means of a hand crank on top of the machine. All coil covering is spun glass fibre, heat-resistant, Class BB insulation. Efficiency is said to be approximately 80 to 85 percent. Except on 300-amp. size, 60-cycle units are fan cooled and have power-factor correction. High and low range switches are provided on 60 cycle units.



Model "TW" a.c. transformer welders; capacities 300 to 1,000 amp.; for 220, 440 or 550 volts, 25- or 60-cycle circuits. **Wilson Welder and Metals Co., Inc.,** 60 East 42d St., New York, N. Y.

•

Unit Substations

Compactly designed for power and lighting service, new line of metal-inclosed, factory-built unit substations consist of one or more metal-clad switchgear units in the incoming-line section, a three-phase transformer filled with oil or pyranol, and one to fifteen metal-enclosed air circuit breakers on the low-voltage feeder side. They provide protection and control for the low-voltage feeders. Units are delivered in two or three

Unit substations (outdoor type illustrated); transform power from the 2,300- to 15,000-volt range to 600 volts or below. **General Electric Co.,** Schenectady, N. Y.

sections and are installed by bolting together and connecting the power cables. All wiring, control and metering equipment is mounted on hinged panels. Mechanical interlocks prevent connecting or disconnecting of the breaker while it is closed. Removal of back plates permits access to bus, current transformers and feeder connections for each breaker.

•

Time Switch

Model "TS-41" time switch; single pole single throw; 35 amp. at 115 and 230 volts, a.c.; timing range, minimum 15 minutes, maximum 21 hours. **International Register Co.,** 15 South Throop St., Chicago, Ill.

Designed for single-cycle operation, where only one automatic "on" and "off" operation is required in any 24-hour period, this time switch is suitable for controlling flood-

AMCRECO Creosoted POLES
For STRENGTH THAT LASTS
THIS AMCRECO BRAND
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4
35
GUARANTEES QUALITY
AMERICAN CREOSOTING COMPANY
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ADDRESS INQUIRIES TO CHICAGO, ILL., OR LOUISVILLE, KY.

Working together for Defense!

Teamwork all along the line is vitally essential in this time of national emergency. Whether the job is one of keeping open the lines of traffic and communication, or of keeping an endless flow of equipment and materials streaming from production lines—the task calls for the best efforts and cooperation of all.

Roebling believes that it can best do its part, despite the unremitting pressure of emergency demands, by unceasingly maintaining the high standard of quality for which Roebling Electrical Wires and Cables are noted—a standard of quality that is an assurance of safety and all-around dependable service.

ROEBLING
ELECTRICAL
WIRES AND CABLES

JOHN A. ROEBLING'S SONS COMPANY TRENTON NEW JERSEY

Branches in Principal Cities Export Division: 19 Rector St., New York, N.Y., U.S.A. Cable Address: "Roebling's", New York

lights, yard night lights, attic ventilating fans, signs, etc. It may be turned "on" and "off" manually, irrespective of time settings, but the time cycle is resumed automatically. It is operated by a self-starting synchronous motor.

•

TECHNICAL LITERATURE

LIGHTNING PROTECTION—Engineering information on lightning protection for distribution systems and equipment is contained in the Engineering Section (59 pages) of a 112-page publication, "Lightning Protection," Catalog No. 415, issued by Electric Service Supplies Co., 17th and Cambria Sts., Philadelphia, Pa. Some subjects covered are Lightning Arrester Design vs. Service Characteristics, Interconnection and "Balanced Protection," Protection for Feeder Voltage Regulators, Tank Mounted Arresters, and Lightning Protection for Rural Lines. Technical and catalog information on the company's lightning arresters and protective gaps are included.

REPORT—A report of the power station, chemistry subcommittee of the prime movers committee, E.E.I., includes data on determination of hydrogen evolution as reported by three operating companies. Description of the apparatus used and discussion of the information obtained is presented. A progress report on the general subject "carry-over" is submitted. Also presented is a description and flow diagrams of an installation of a carbonaceous zeolite water softener which includes a summary of operating results and costs over a one-year period. Copy of the report, Publication No. H-11, "Power Station Chemistry—1940," may be obtained from Edison Electric Institute, 420 Lexington Ave., New York, N. Y. Price $1.00 to non-members in U.S.A.

N.E.M.A. STANDARDS—A reference book representing standardized practice in the United States contains information concerning the manufacture, test, and performance of alternating and direct-current motors and generators and combinations of both, but excluding motors for railroads, mining locomotives, generators for arc welding, toy motors and generators, and fans of the desk, bracket, and ceiling type. This publication, No. 41-64, "NEMA Motor and Generator Standards," supersedes publication 38-49. Copy may be obtained from National Electrical Manufacturers Association, 155 East 44th St., New York, N. Y. Price $3.50.

TEST CODE FOR D.C. MACHINES—A list of 18 tests applicable to all d.c. generators and d.c. motors, recommended sequence of making tests, and acceptable methods of making tests, are included in Publication No. 501, July 1941, which is obtainable at 50 cents per copy from American Institute of Electrical Engineers, 33 West 39th St., New York, N. Y.

PROPERTY CHART—Physical properties of steatite, cordierite and lava bodies are contained in a chart which will be of interest to electrical and chemical engineers, as well as executives in all fields using technical ceramics. There are also included curves on linear thermal expansion and volume resistivities with varying temperatures of Alsimag ceramic compositions. Copy of Engineering Data and Property Chart No. 416, "Properties of Ceramic Insulating Materials," may be obtained by addressing a request to American Lava Corp., Chattanooga, Tenn.

Where trustworthy tools are vital

Vital link in America's mammoth distribution scheme are the thousands upon thousands of giant trucks that day and night ply the nation's highways. With millions of dollars invested in rolling stock, the trucking industry must "keep them rolling" to make a profit. In the shops, Crescent and Crestoloy Tools play a prominent part in service and maintenance work, and on the road, they help to keep the pay loads moving.

Crescent Tools include adjustable wrenches, pliers of all types, hacksaws, snips, screwdrivers, etc., etc. They are sold under the "Crescent" and "Crestoloy" trade names by hardware dealers and industrial distributors everywhere.

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

YOU CAN ALWAYS DEPEND ON

CRESCENT TOOLS

NEWS ABOUT PEOPLE

Associated Electric Names Tegen President

Directors of Associated Electric Co. have elected A. F. Tegen as its president. He also was elected director, along with Willard L. Thorpe, co-

Kaiden-Keystone

A. F. Tegen

trustee of Associated Gas & Electric Corp. Denis J. Driscoll, the other trustee, formerly president of Associated Electric Co., continues as a director.

At the same time the board authorized the establishment of a complete organization to handle the company's affairs. Heretofore Associated Electric Co. had retained Atlantic Utility Service Corp., service company of the Associated System, in the administration of its affairs. These actions constituted a major move by the trustees in the reorganization of Associated Gas & Electric Corp.

The personnel for the new organization for Associated Electric Co. has been recruited from the present staff of Atlantic Utility Service Corp. Mr. Tegen will resign as vice-president and director of that corporation. He has had extensive experience in the utility field since 1924, when he was graduated from the University of Wisconsin. At that time Mr. Tegen joined Wisconsin Electric Power Co. and served in various capacities until 1935, when he joined the staff of the Securities and Exchange Commission in the public utility division. He remained there until last year, when he became affiliated with Atlantic Utility Service Corp.

Other officers of Associated Electric Co. elected included W. G. Christie, comptroller; P. R. Lawson, treasurer, and J. H. Mackenzie, secretary.

•

▶ R. V. TERRY, formerly hydraulic engineer for the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., has been promoted to the position of assistant chief engineer. Mr. Terry entered the employ of the Newport News organization in 1919 as a draftsman, becoming chargeman in 1922, assistant engineer in 1923, assistant hydraulic engineer in 1926 and hydraulic engineer in 1929. He received his education at the University of Richmond and the North Carolina State College.

Cleland Heads San Diego Utility; Raber Retires

Retiring after 50 years of distinguished service as an electric, gas and street railway executive, William F. Raber, president of the San Diego Gas & Electric Co., presented his resignation to the company's board of directors. The board immediately elected Hance H. Cleland, president of the California-Oregon Power Co., as his successor. Mr. Cleland will take office immediately. Mr. Raber has agreed to remain with the company in an advisory capacity to the president and board of directors.

Mr. Raber became the directing head of the San Diego utility in 1924, going there from Pueblo, Colo. Before assuming his duties in San Diego, he had held important executive positions in five or six utilities. During his seventeen years in San Diego Mr. Raber has seen his company grow from 81,997 gas and electric customers in 1924 to the present, though somewhat abnormal, total of 190,414. He has taken an active interest in both electric and gas

CLELAND TAKES OFFICE—Hance H. Cleland (left) has been chosen to succeed William F. Raber (right) as president of San Diego Gas & Electric. Mr. Raber retired after completing fifty years of service in the utility industry

ORANGEBURG HAS BEEN A LASTING NAME "UNDERGROUND" FOR 48 LONG YEARS

ORANGEBURG CONDUITS

are contributing to the uninterrupted flow of airplane production by providing complete and lasting cable protection

ORANGEBURG *Standard* for installation *with* concrete encasement
NOCRETE for installation *without* concrete encasement

Photograph by Nesmith

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ORANGEBURG *Conduits*

MADE AT ORANGEBURG, NEW YORK, BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVENUE, NEW YORK CITY

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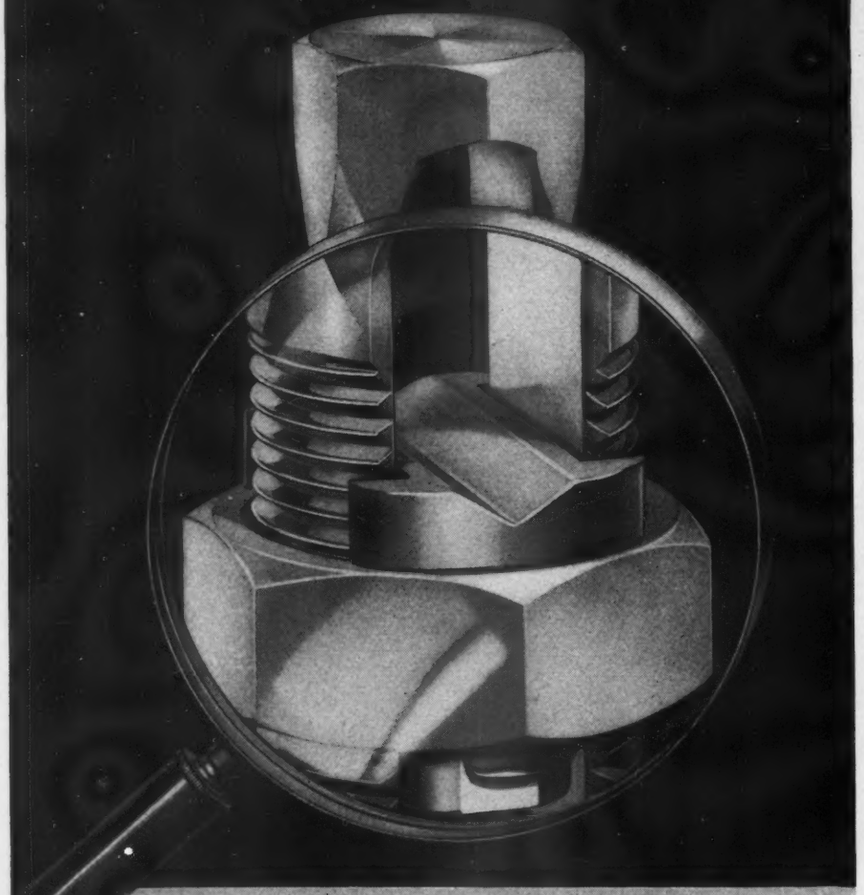
GENERAL ELECTRIC SUPPLY CORP. GRAYBAR ELECTRIC CO., INC.

9-FC-1

The Secret Of High Pressure Contact At Low Wrench Torque



Look closely at the clean-cut threads on any L-M High Strength Connector, run your fingers over their keen, smooth edges . . . right there you have the "secret" of efficient L-M threads, of high pressure contact at low wrench torque. Threads on both nut and body of L-M High Strength Connectors are machined with the same precise care. High Strength alloys make both the nut and body rugged, immune to years of "weathering". That is why L-M High Strength Connectors give you perfect, permanent conductor contacts, even after years of repeat use. Specify L-M in your next connector order.

LM

LINE MATERIAL COMPANY

GENERAL OFFICES • MILWAUKEE, WISCONSIN

trade associations for a number of years.

For some time Mr. Raber has desired to terminate his office, but had remained on with the company until plans for meeting national emergency requirements were well under way. In Mr. Cleland, according to a spokesman for the company's board of directors, "we have found a man fully capable of carrying on at full speed. He has had a wide diversity of experience in the field of utility operation both from his viewpoint as a former member of the Public Service Commission for the state of Washington and as president of a large northwestern utility. He has also distinguished himself in the legal profession as Assistant Attorney-General for the state of Washington and in private law practice in Olympia and Chicago."

•

Koppitz and Heberlein Assigned New Duties

C. G. Koppitz has been elected vice-president and consulting engineer of Railway & Industrial Engineering Co., Greensburg, Pa., and G. E. Heberlein has been appointed to take over Mr. Koppitz' former duties as chief engineer.

Mr. Koppitz' varied and interesting

C. G. Koppitz

career in the electrical industry began in 1896 with the operation of the steam station in San Jose, Calif. This connection was followed by two years spent in the erection and operation of a pioneer 1,155-ft.-head hydro development near Sonora.

The next four years were spent in Europe, two with the French Westinghouse company as erecting and operating engineer at the company's working exhibit which supplied power to the moving platform encircling the Paris Exhibition of 1900 and two in sales

Never too busy to be Good Neighbors

THERE are a lot of workers in the Bell System — about 350,000 of them. That's a big family and it likes to be a friendly kind of family.

Whether it be the installer in the house, the people in our offices, the operators or the lineman on the roadside helping to rescue a stray kitten for a worried youngster, telephone workers are close to the public and the tradition of the job is helpfulness.

Even in these days when the needs of defense place sudden and increasing demands on telephone workers, they are never too busy to be good neighbors.

Bell Telephone System

"The Telephone Hour" is broadcast every Monday. (N. B. C. Red Network, 8 P. M., Eastern Daylight Saving Time.)

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work with the British Westinghouse in London and Birmingham.

Entering the employ of Sanderson & Porter, Mr. Koppitz engaged for several years in the erection of electrical mill equipment and hydro plants, also in the erection and operation of steam station equipment in Youngstown, Ohio. Later he entered the personal employ

G. E. Heberlein

of George Westinghouse on the experimental production of silicon monoxide in a vacuum type electric furnace.

After short periods of employment with Mahoning and Shenango Railway & Light Co., West Penn Power Co. and National Insulator Co. and also a period of six months spent in private research work, he joined the Railway & Industrial Engineering Co. in 1914.

Mr. Koppitz has made many contributions toward the improvement of blade-switching equipment, but probably the most outstanding was his induction in 1925 of the "Hi-pressure Contact" first on outdoor switches and later on indoor types. He is also well known for his development of the "Koppat" line of resistors.

Following graduation from Washington State College in 1926, Mr. Heberlein entered the employ of Westinghouse Electric & Manufacturing Co., spending one year in the graduate student course. With Westinghouse he served as development engineer on carrier current relaying, supervisory controls and switching equipment design. Late in 1936 he became manager of switchgear device sales and left this position early in 1941 to enter the employ of Railway & Industrial Engineering Co.

OBITUARY

► F. D. Sampson, superintendent of distribution for the Duke Power Co., Charlotte, N. C., died at his home in that city on August 24, after an illness of several months. A native of Eng-

SPECIFY F-M MOTORS

with the Copperspun Rotor

for "ALL OUT" Production

There's no motor so capable of standing up to today's production tempo . . . of operating dependably under the most severe plugging and reversing service . . . as the Fairbanks-Morse Motor with one-piece rotor winding centrifugally cast of SOLID COPPER.

That's because copper has better electrical, thermal, and mechanical characteristics for motors than any other metal of which rotors are cast. You get the unique benefits of cast copper rotors in F-M Motors without extra cost . . . only F-M has succeeded in producing the *Copperspun* rotor.

Get the complete story of what F-M Motors with the patented features of Copperspun rotors can do for you in speeding production, reducing operating costs, and giving added years of trouble-free service. Write Fairbanks, Morse & Co., Dept. I-27, 600 S. Michigan Ave., Chicago, Ill. Branches and service stations throughout the United States and Canada.

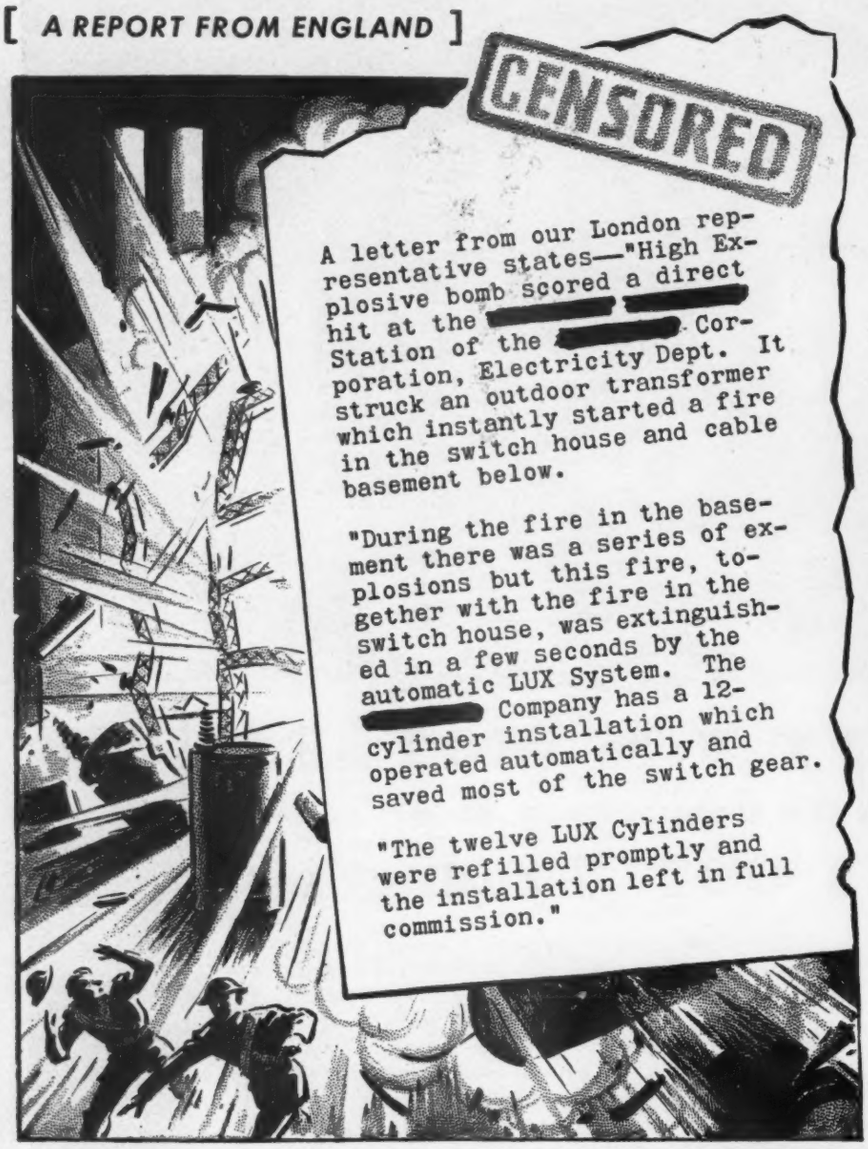
Copperspun Patented

FAIRBANKS·MORSE MOTORS

DIESEL ENGINES ELECTRICAL MACHINERY RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

H. E. BOMB SCORED DIRECT HIT ON TRANSFORMER!

[*A REPORT FROM ENGLAND*]


CENSORED
A letter from our London representative states—"High Explosive bomb scored a direct hit at the [redacted] Corporation, Electricity Dept. It struck an outdoor transformer which instantly started a fire in the switch house and cable basement below.
"During the fire in the basement there was a series of explosions but this fire, together with the fire in the switch house, was extinguished in a few seconds by the automatic LUX System. The [redacted] Company has a 12-cylinder installation which operated automatically and saved most of the switch gear.
"The twelve LUX Cylinders were refilled promptly and the installation left in full commission."

It isn't that we think there will be bombings of your properties. But accidents happen . . . serious accidents which cause critical fires. Automatic built-in extinguishing systems are a front-line defense against the damage fire can do.

The LUX System that "saved most of the switch gear" at that English substation was a peacetime installation. Yet it was a fortress of protection when the Luftwaffe struck with H. E. Bombs.

Are you ready for the fires of peacetime?

Automatic built-in LUX extinguishing Systems provide a brilliant answer.

Walter Kidde & Company
INCORPORATED
928 West Street, Bloomfield, N. J.

land, Mr. Sampson came to this country when a young man. Early in his American life he entered the electrical business. Among the first big projects he worked on were electric railway systems in Duluth, Minn., and Seattle, Wash. He went to Charlotte in 1895 to take charge of the electrical and street railway systems of the old Four C's Co. In 1904 he was employed by W. S. Lee as superintendent of the Charlotte division of the Catawba Power Co., predecessor of the Duke Power Co. He continued with Duke Power until his death. Mr. Sampson was a member of the American Institute of Electrical Engineers.

•

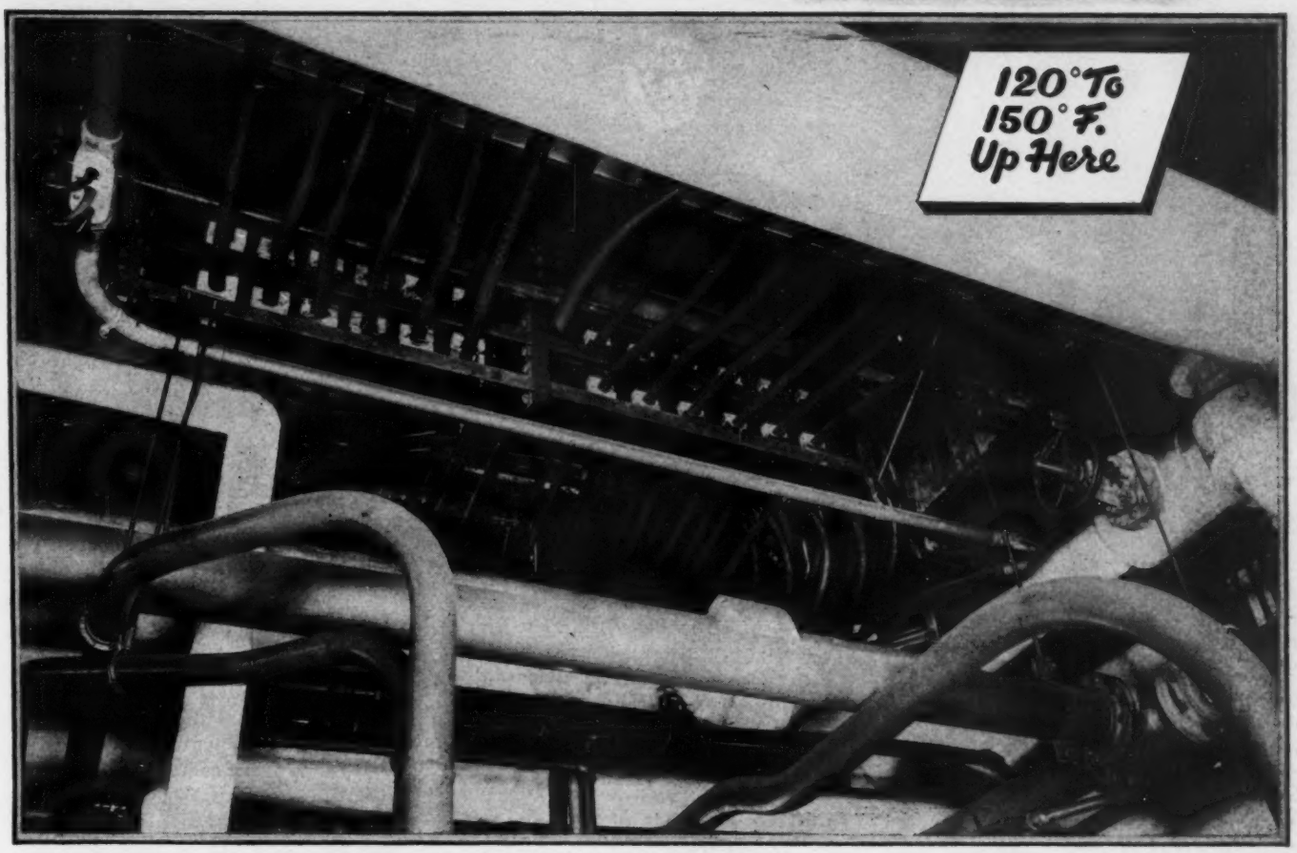
Horace A. Staples

Horace A. Staples, whose death was announced in the August 30 issue of ELECTRICAL WORLD, page 17, had been

a vice-president of Phelps Dodge Copper Products Corp. since 1933, having been affiliated with the National Electric Products Corp., from which Phelps Dodge was formed in 1932.

Mr. Staples was born in Stockton, Me., in 1880. He came to New York in 1896 and undertook studies at Cooper Union, later obtaining his degree in engineering at Pratt Institute in 1902. He was superintendent of the plant of the Bridgeport Brass Co. in 1916, and went from that position to the British-American Metals Co. in Plainfield, where he was one of the original organizers.

Mr. Staples was a member of the American Society of Mechanical Engineers and held membership on many important committees of that organization. He was also a member of a number of other technical societies, including the Institute of Metals (Great Britain), American Society of Testing Materials, American Institute of Mining and Metallurgical Engineers and the Wire Association.



STEAM LINES + WIRE = TROUBLE!

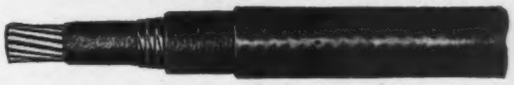
Here's a nest of potential wire failures cooking up future trouble in the insulation-destroying heat of 120° to 150° F. — vital power, control and lighting circuits that are bringing shutdowns and lost production closer every day *because their insulation can't take heat!*

In an installation like this, where circuits had to be run between the steam lines and ceiling, continuous high ambient temperatures combine with conductor heating caused by production overloads to ruin anything but *genuinely heatproof, permanent insulation*. Under such heat, insulation having low temperature operating limits begins to go as soon as it is installed. It dries out, gets brittle, cracks; then moisture enters and you have a rewiring job that may tie your plant in knots.

Another horrible example we saw a few months ago was in a steam tunnel running from a factory power plant to the shops. It was jammed with steam lines, watchman, telephone and fire alarm systems, along with 13 – No. 1/0 AC lighting circuits, 16 – 500,000CM DC power circuits and 22 – 500,000CM low voltage AC power circuits. Temperatures of 110° to 130° F. had dried them out so badly that an arc would have burned the tinder-dry insulation and crippled operations. It could have been rewired weekends with *heatproof, fireproof, permanently insulated* Rockbestos, but they were "too busy" — now they're working full time and are hoping that it won't blow.

These two examples illustrate the need for *permanent insulation* wherever wire is exposed to severe operating conditions and the necessity for anticipating your requirements. Send for a catalog and samples. Rockbestos Products Corporation, 814 Nicoll St., New Haven, Conn.

Rockbestos A.V.C. Boiler Room and Lighting Wire
(Underwriters' and Nat. Elec. Code — Type AVA
maximum operating temperature 110°C. (230°F.)



Rockbestos A.V.C. Power Cable
(Underwriters' and Nat. Elec. Code — Type AVA
maximum operating temperature 110°C. (230°F.)

Rockbestos All-Asbestos Power and Rheostat Cable
(Underwriters' and Nat. Elec. Code — Type AI
maximum operating temperature 125°C. (257°F.)

TEN TESTED ROCKBESTOS VALUES that will pay you dividends

1. HEATPROOF
2. FIREPROOF
3. PERMANENT
4. Lower maintenance cost
5. Resists heat and vibration
6. Saves work
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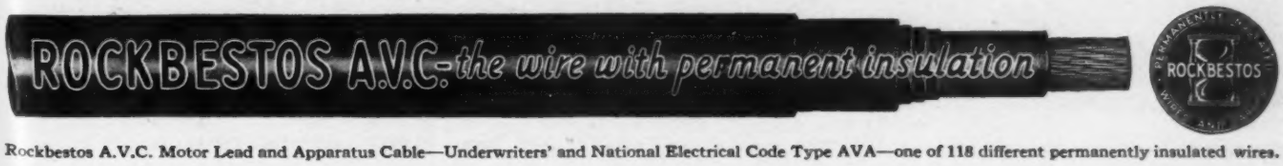

Rockbestos A.V.C. Motor Lead and Apparatus Cable—Underwriters' and National Electrical Code Type AVA—one of 118 different permanently insulated wires.

MANUFACTURING-MARKETS

Westinghouse Plans Capital Increase

Approximately $60,000,000 of new capital is needed by Westinghouse Electric & Manufacturing Co., according to a letter from A. W. Robertson, chairman, and G. H. Bucher, president, sent to stockholders announcing the purpose of a special stockholders' meeting October 29. The need arises from the unprecedented expansion of the company's business in the last two years, due principally to the increasing demands of the national defense program.

The expansion requires the investment of some $75,000,000 in buildings and manufacturing equipment, in addition to $52,000,000 of plants being constructed for and at the expense of the federal government.

The new capital will enable the company to repay its existing bank loans, to provide for further plant construction and to supply its enlarged working capital requirements.

Part of the new money will be raised through the issuance of additional common stock, which will be offered to stockholders for subscription, and the balance will be obtained through the issuance and sale of medium-term unsecured debentures. A proxy statement, covering essential details of the financing, will be sent to shareholders when the program has been definitely formulated, it was announced.

More than 50 percent of the orders on Westinghouse's books are for equipment required in national defense. These orders amounted to about $250,000,000 on July 31 and included such principal items as turbines and other propulsion gear for more than 100 United States Navy vessels, radio equipment for ships, land stations and aircraft, special equipment for tanks, lighting equipment for airports, bomb fuses, gun mounts, switchgear and generating equipment for defense plants.

•

Hygrade Stages Second Lighting Conference

A second conference on fluorescent lighting is to be sponsored by the Hygrade Sylvania Corporation at Salem, Mass., on September 8 and 9, the guests to be lighting engineers from utilities in the metropolitan New York, Pennsylvania and southeastern states utilities. While the program will follow the general pattern of the conference held in June with engineers from New England and upper New York state utilities, it is anticipated that the discussions will bring out fresh material and new viewpoints.

•

NEMA Publication

The National Electrical Manufacturers Association has just published "NEMA Motor and Generator Standards," containing revisions of such standards published in 1938.

G. E. Joint Meeting on Fluorescent Units

Nearly two hundred representatives of fluorescent lighting equipment manufacturers attended a two-day conference held last week by the General Electric Company at Nela Park for the discussion of the application and trends in fixtures and accessories. This conference was jointly sponsored by the several divisions of the company responsible for the manufacture of lamps, starters, ballasts, accessories and plastics, and was under the general direction of E. D. Stryker, newly appointed coordinator for all General Electric fluorescent lighting products.

It was disclosed that 1941 lamp sales would go somewhere between 18 and 22 million tubes, with 1942 conservatively estimated at more than 30 million.

Fixture manufacturers were given the opportunity of discussing with General Electric factory specialists the technical and application phases of the several elements of fluorescent fixtures. The conference ended with a presentation of the company's promotional program.

•

Copper Scrap Ceiling

Copper scrap, which has been selling at levels completely out of line with the price of copper, is restored to a fair relationship in Price Schedule No. 20, recently announced by OPACS. The scrap ceiling establishes price dif-

Fluorescent lighting fixture manufacturers attending two-day conference at Nela Park

QUIT STABBING POLES
● Use the new Multipoint Cant Hook. Its 6 points, ¼ in. x ½ in. in size, hold better than a single long point. Leave no deep stab holes where water collects and rot starts—do not damage the creosote treatment. The Multipoint Cant Hook grips more securely even the smallest diameter poles which are so difficult to handle with the standard single point hook—spreads strain over wider area—is self-releasing. Furnished in 3 sizes for handling poles up to 22 inches in diameter. Multipoint speeds up pole handling in the yard—eliminates damage—saves time and money. Made by the American Fork & Hoe Company, Cleveland, Ohio.
STURDETOOLS
a TRUE TEMPER PRODUCT
STURDETOOLS
MULTIPOINT CANT HOOK
6 points ¼"x½" in size grip the pole securely but leave no deep hole to encourage rot and decay.
Furnished in small, medium and large sizes for handling poles up to 22" in diameter. Prices and complete description on request.
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Branches and Warehouses with Complete Stocks in Principal Cities of the United States

ferentials of from 2 to 4 cents a pound below 12-cent copper for the leading kinds and grades of scrap. A uniform dealers' margin of ¾ cent a pound for collecting, sorting, storing and shipping is also allowed.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

W. N. Matthews Corp., St. Louis, Mo., has made C. H. Alvord of the Alvord Engineering & Sales Co. its representative for the sale of Matthews products in the State of Connecticut.

The company has also appointed Miss Margaret H. Gilliam of the E. H. Gilliam Co. as representative for the sale of Matthews products in the state of North Carolina.

A. B. Chance Co., utilities division, Centralia, Mo., has announced that Dwight Argo, has joined the organization as junior salesman under Bill Moss, who covers the southeastern territory, which includes the states of Tennessee, North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Florida. Mr. Argo was formerly connected with the Alabama Power Co.

•

Electrical Goods Orders Set Six-Month Record

New orders booked for electrical goods during the first six months of 1941, as reported by 78 manufacturers, totaled $1,135,790,131, an all-time high, according to the Department of Commerce, and within 26 percent of the total for all of 1940.

Orders booked during the second quarter amounted to $581,674,663, as compared with $554,115,468 in the first quarter and with $268,120,065 in the second quarter of 1940.

•

Vacuum Cleaner Sales Up

Vacuum cleaner sales during the month of July, 1941, amounted to 182,324 units, compared with 94,610 units for the similar month of 1940, according to an announcement released by the Vacuum Cleaner Manufacturers Association.

New York Metal Prices

	Sept. 2, '41 Cents per Pound	Aug. '27, '41 Cents per Pound
Copper electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.85	5.85
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spots	7.64	7.64
Tin, Straits	52.00	52.00
Aluminum, 99 percent	17.00	17.00

*Delivery Connecticut Valley.

INSL-X
NOT JUST SOMETHING NEW
. . . ACTUALLY SOMETHING BETTER
in INSULATION
for BUS BARS, LINE COILS, TOOLS, etc. . .

SPECIFICATIONS
INSL-X #33
Dielectric Strength—1500 v/mil.
Tensile Strength—2000 lbs. per sq. in.
Specific Gravity of Solution—.895 to .905, average .900
Weight per Gallon—app. 7.25 lbs.
Fire Resistance—Slow burning
Heat Resistance—Softens at 90° C melts at 220° C.
Impact Resistance—Tough, not brittle, even at sub-zero temperatures. Withstands 1-20 ft. lbs.
Chemical Resistance—Resists acid, alkali up to 40% conc. and Sodium Hydoxide.
Oil Resistance—Insoluble in mineral oil and gasoline.
Ultra violet Resistance—Transparent 2800-4500° AA.

Test INSL-X at our expense! You'll be amazed at the ease of application (brush, dip, or spray), the efficiency, the economy. No other material combines all the advantages of INSL-X. Send for Free Samples Today!

INSL-X LABORATORY SERVICE
Let INSL-X's engineers cooperate to solve your insulation problems. Samples of INSL-X will be furnished Free upon Request.

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THE INSL-X CO., Inc. Dep't W
857 Meeker Ave., Brooklyn, N. Y.
Without obligation, please send:
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Electrical Manufacturers

1942 EDITION CLOSING SOON!

The 1942 edition of Electrical Buyers Reference closes October *1st.* 30,000 copies will be distributed to the leading buyers of electrical products in utilities, in large industrial plants, electrical contracting and wholesaling establishments, railroads, mines, engineering organizations, etc.

Electrical Buyers Reference offers you an unusual opportunity to place *your* condensed catalog (Briefalog) in the hands of this carefully picked list of buyers. *And these buyers USE Electrical Buyers Reference, repeatedly.*

First, because it's the handy, convenient way for them to keep —and *find*—buying and specifying information on the products they use daily.

Second, because a continuous barrage of promotion reminds recipients of the wealth of information that the reference contains and urges them to use it on every occasion. If any one manufacturer did a comparable job promoting his individual catalog the cost would exceed $20,000 yearly!

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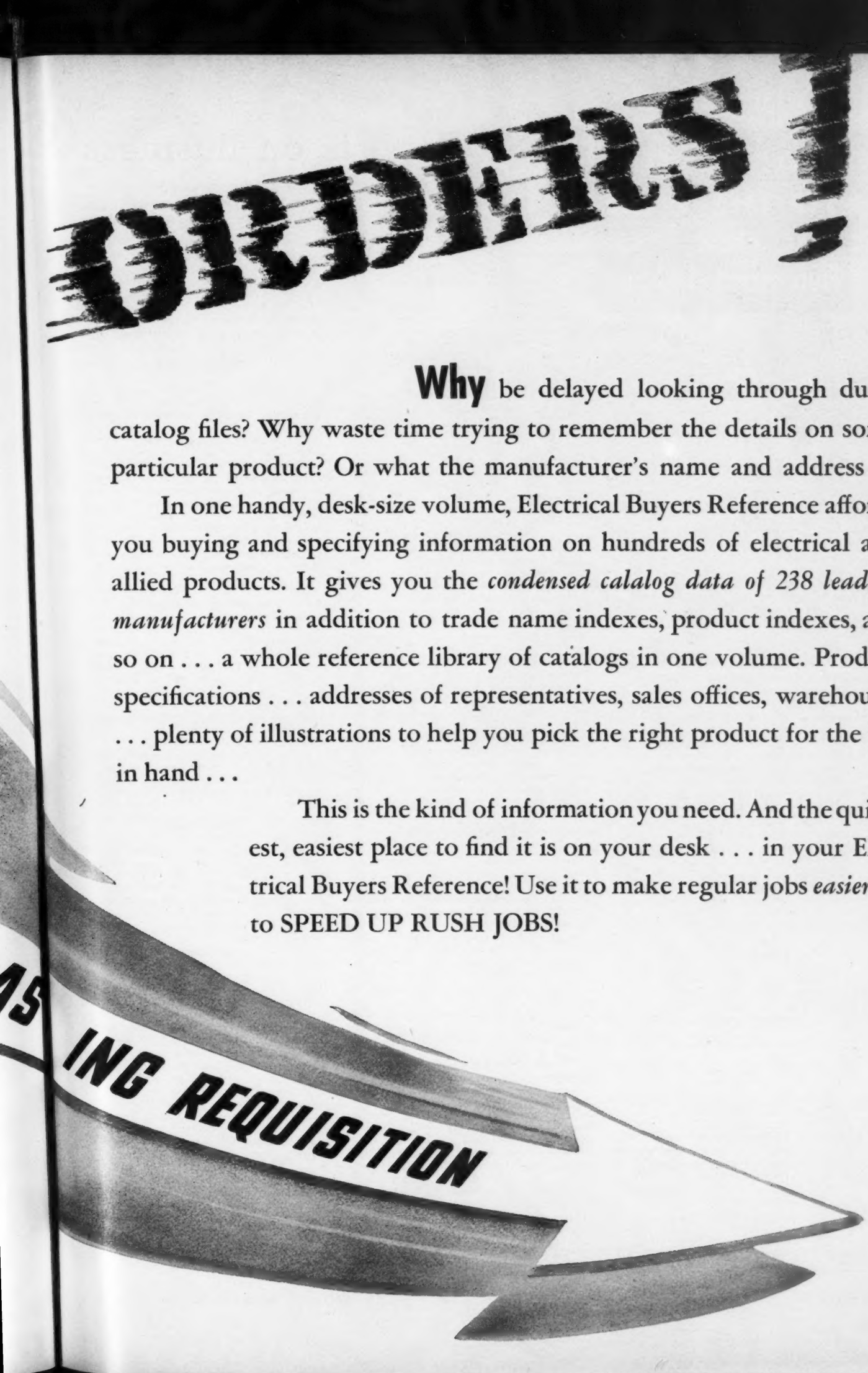
All the facts about Electrical Buyers Reference—who gets it, how they use it, what it costs, and so on—are contained in a folder which we've just issued. Write for your copy.

ORDERS!

Why be delayed looking through dusty catalog files? Why waste time trying to remember the details on some particular product? Or what the manufacturer's name and address is?

In one handy, desk-size volume, Electrical Buyers Reference affords you buying and specifying information on hundreds of electrical and allied products. It gives you the *condensed calalog data of 238 leading manufacturers* in addition to trade name indexes, product indexes, and so on . . . a whole reference library of catalogs in one volume. Product specifications . . . addresses of representatives, sales offices, warehouses . . . plenty of illustrations to help you pick the right product for the job in hand . . .

This is the kind of information you need. And the quickest, easiest place to find it is on your desk . . . in your Electrical Buyers Reference! Use it to make regular jobs *easier* . . . to SPEED UP RUSH JOBS!



A WORD TO THE WISE about Fluorescent Lighting

BY

Thomas J. Killian, Ph.D.

Former Instructor in Electrical Engineering and Physics at M. I. T.; pioneer in the development of gaseous tube light; and now Technical Director of The Frink Corporation.

BECAUSE it is the greatest development in illumination during the past decade, the growth of Fluorescent lighting has been phenomenal. Sales of Fluorescent lamps have jumped from 250,000 units in 1938 to an expected 20,000,000 in 1941.

Such rapid expansion has of course resulted in considerable confusion. Hundreds of "companies" have been organized to cash in on the new demand. And thousands of "fluorescent experts" have sprung up to "prescribe" for Fluorescent installations. Inevitably, much money has been wasted by ill-advised purchasers who accepted misinformation as engineering facts.

To discourage the sale of inferior or unsafe Fluorescent equipment certain standards of quality have now been established. These are met or exceeded by reputable manufacturers like The Frink Corporation. However, such standards apply only to the *fixtures* themselves. They do not cover engineering factors involved in planning a complete installation. Consequently, even so-called "approved" fixtures may produce inefficient, inappropriate or extravagant Fluorescent lighting.

For this reason, The Frink Corporation pioneered a *complete* Fluorescent lighting service to *guarantee satisfaction* to purchasers of Barkon-Frink LINOLITE equipment. Not only does every Linolite fixture meet the quality standards for Certified Fleur-O-Liers, but each Linolite installation is *Engineered for Guaranteed Performance* at no extra cost.

Once installed, little can be done to correct poorly engineered Fluorescent lighting. That is why our constant advice is to "Do it *right* or *not at all*". That, also, is why we maintain *our own staff* of skilled designers and engineers, backed by Frink's 84-year experience in lighting, to—

Do it RIGHT with

L-I-N-O-L-I-T-E
(Trade Mark)

A profusely illustrated brochure, showing how and why LINOLITE affords the Ultimate in Fluorescent Lighting, is yours for the asking. Mail the coupon now.

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Field Reports on Business

Under the stimulus of defense orders, production, employment, payrolls, construction and trade are being carried to boom proportions. Orders for all types of electrical equipment are being received, in some instances the demand exceeding the supply.

NEW ENGLAND

The steady flow of government defense contracts into this district was featured last week by several large awards to Connecticut industries. American Brass Co. was allocated in the neighborhood of $20,000,000 for cartridge brass; New Britain Gridley Machine Co. received an order for $4,467,315 worth of automatic screw machines, bringing the total of war orders now held by New Britain industries to more than $10,000,000; Colts, $685,672 in gun parts; Bridgeport Brass Co., $758,827 for cartridge brass; Veeder-Root, fuses for $577,500, and Stamford Rolling Mills, $174,000 for brass products. The result of these huge awards and of others to come cannot be otherwise than stimulating to buying in electrical markets.

Ground has been broken for a $2,000,000 defense housing project at East Hartford, Conn. A wiring contract has been awarded for a $6,000,000 hospital at Hartford, Conn. Commercial electric cooking equipment purchases at Hartford include 3-kw. "Auto-Chef" and a 10-kw. Hotpoint roast oven for one restaurant, and a 9.2-kw. Hotpoint oven, a 6.2-kw. steam cooker for another, and 40 kw. in drug-store installations. Four banks in the Boston suburban area are each to install new fluorescent lighting, ranging from 10 to 15 kw. capacities, air-conditioning units for each, ranging from 7.5 to 12 hp., with each bank face to be floodlighted.

A Massachusetts manufacturer is installing 40 kw. in infra-red processing equipment. Small air-conditioning units for restaurants and apparel shops have been selling well. A new Boston store has installed 35 kw. in new lighting.

PACIFIC COAST

Serious regional shortages of wiring staples continue to develop, such as San Francisco's lack of rubber-covered wire, but revised specifications and the combing out of hitherto obscure brands is somewhat relieving these situations for the lower priority ratings. However, a recent $600,000 San Francisco housing project had no bidders and was postponed.

Southern California Edison is installing a $50,000 tower and switching station job at Boulder; city of Glendale is buying 50,000 ft. of heavy varnished cambric cable, principally large circular mil sizes, and Los Angeles has bought $31,392 pump units and $147,000 seven-duct conduit for its Harbor steam plant. The 334 miles of 33,000-volt tie-in and distribution line from Eugene, Ore., to the Bonneville system will cost $449,465. Bonneville plant purchasing includes a carload of conduit, intake gates costing $495,040, 2,000,000 ft. of cable and crossover accessories for the 230-kv. tie-in to Grand Coulee and 160,000 suspension insulators for miscellaneous lines.

Miscellaneous industrial buying covers $20,000 fractional-horsepower motors for oil burners and pumping systems, $6,000 armature coils for a street railway, $10,000 calculagraph motors, $12,000 water-control equipment for an irrigation system and $9,500 of dredging cable. Appliance firms are reflecting apprehensions over inability to procure stock by adding furniture and other departments and some releases of appliance salesmen are reported, principally in interior city branches.

NEW YORK

Business activity continued to make further gains during the past week, with virtually all elements recording further advances.

The month of August drew to a close with sales gains in major electrical appliances almost as large as those in the early months of the year. Manufacturers continued to supply merchandise in large quantities to distributors and dealers, although not in as large amounts as was sought, in a last-minute effort to beat the proposed curtailment program. No actual curtailment order has been issued, so manufacturers continued to produce goods at maximum.

Engineering construction awards for the week, $124,233,000, advanced sharply to gain 55 percent over last week's total, topping the volume for the corresponding 1940 week by 116 percent, according to *Engineering News-Record*. The week's awards bring 1941 construction to $4,329,627,000, a 103 percent gain over the total for the 35-week period in 1940.

The employment index in July rose to 130.5 percent of the 1923-25 average and the payroll index to 152.5 percent, record levels.

Retail trade is responding briskly to seasonal demands. In many lines business was of rush proportions. Prices moved higher, touching a new peak for recent years.

CHICAGO

Many appliance and lighting fixture manufacturers are forced to curtail production drastically because of inability to secure the necessary parts and materials. The growing list of materials coming under priorities is causing considerable adjustment of products and personnel in strictly non-defense lines.

Inquiry among manufacturers reveals that orders for practically all types of electrical equipment are being received in large volume, in many instances far exceeding the ability to supply the immediate demand. One manufacturer's representative was forced to turn down orders for eighteen carloads of rigid conduit. Several companies reported that they are attempting to supply only regular customers.

Of 34 manufacturers reporting July sales to the Electric Association, 27 showed increases over the previous month, while 32 had gains over July, 1940. Increases ranged from 5 to 200 percent over last year's volume. All of the electrical wholesalers reporting showed substantial increases over a year ago.

National defense contracts placed here last week receded somewhat. Orders for electrical equipment included circuit breakers, $70,896; trucks, $10,470; wire and cable $306,685; portable tools, $143,650; dry batteries $1,174,720; telephone cabinets, headsets, plugs, etc., $247,975; teletype machines, $704,653.

A.S.A. to Set Up Refrigerator Standards

Possibility that household refrigerators will be limited to two or three sizes is contained in the recent announcement by P. G. Agnew, secretary of the American Standards Association, that the Office of Price Administration and Civilian Supply had asked the association to set up standards for this product at once. The purpose of such standards would be to assure the public of serviceability of domestic refrigerators in the face of shrinking supplies of raw materials and to cut down all unnecessary variety in sizes and styles in order to conserve production facilities.

In the request OPACS suggested that standardization should include concentration on a small number of sizes, perhaps but two or three, and should specify minimum performance requirements. It was felt that such standardization would be effective in conserving materials and in facilitating use of substitute materials as well as bringing about important economies in production and distribution and consequent better service to consumers.

•

Milwaukee Will Protest Defense Restrictions

Mayor Carl F. Zeidler of Milwaukee has launched a movement on behalf of that section of American business and industry whose future welfare is seriously threatened by merchandise shortages that may be caused by the national defense program. Distributors and retailers of electrical appliances are seriously affected because it is reported that production of major electrical appliances may be restricted to as much as 50 percent of present production.

Mayor Zeidler is planning a thorough study of the situation to prevent the crippling of employment and business in the community through excessive restrictions of material and merchandise.

The subject was given preliminary study at a recent conference of leading representatives of the electrical appliance business in the city.

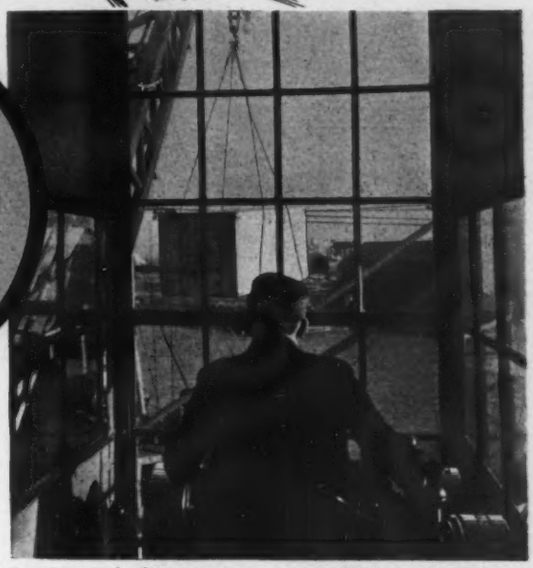
•

New Lead and Zinc Unit

Federal Mining & Smelting Co. has constructed a new lead and zinc mill at Granby, Mo. Empire District Electric Co., Joplin, Mo., has installed a 1,500-kva. substation to serve this load, which has a connected load of approximately 1,200 hp. The mill has an hourly capacity of 75 tons.

NO Jar NO Bump NO Jolt

E&M with



Interior view of crane-cab at eastern railroad pier, showing compact EC&M Master Switches conveniently grouped within easy reach of the operator.

EC&M FREQUENCY RELAY CONTROL

● You, too, can make a "cushioned landing" with this new EC&M Frequency Relay Control. It permits *weaker values of torque* so essential to smooth and slow lowering of light and intermediate loads, safeguards against speeding in lowering heavy loads—*enables operator to achieve results previously impossible on A-c Motor-Hoists.*

Management and engineers have "raised their sights" for crane performance since seeing this outstanding EC&M control operate. Its extreme accuracy of operation and characteristic EC&M dependability give greater value in crane operation.

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Please send A-c Magnetic Controller Booklet 930

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MOTOR CONTROLS • BRAKES • LIMIT STOPS • MAGNETS

ON HIS WAY TO *Safety*

IT takes tough muscles to do a lineman's job—it takes skill, too, and steady nerves. But the man on the pole knows his Klein equipment will guard his safety. He throws his weight on his climbers with confidence—he knows his belt, his safety-strap, too, are the finest that he can buy when they carry the Klein trade-mark.

Your copy of the Klein Pocket Tool Guide will be sent on request.

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Recent Rate Changes

EDISON LIGHT & POWER CO., serving York and vicinity, has been directed by the Pennsylvania Public Utility Commission to file a reduced rate schedule effecting for customers a saving of approximately $397,000 annually. Unless exceptions are filed by the utility the order becomes final and formally terminates a case which was the first in which the temporary rate provision of the Public Utility Law was invoked by the commission and successfully defended in the U. S. Supreme Court. The rates now in effect were prescribed in the temporary rate order and were considered fair pending final determination. The commission now finds them excessive as the company's actual operating revenues in 1940 amounted to $2,150,786, or $396,675 in excess of the allowable operating revenues fixed in the present rate order. In filing the reduced rates, the commission advices the utility to give consideration to the following: (1) Further simplification of its rate structure by elimination of discriminatory or unnecessary schedules; (2) desirability of a substantial reduction in the wholesale rate to Glen Rock Electric Light & Power Co., an affiliated company adjacent to Edison Co., in order to close the differential between the retail rates of the two utilities; (3) establishment of rates for commercial and power consumers based on demand and consumption charges for consumers having measured demands of 10 kw. or more.

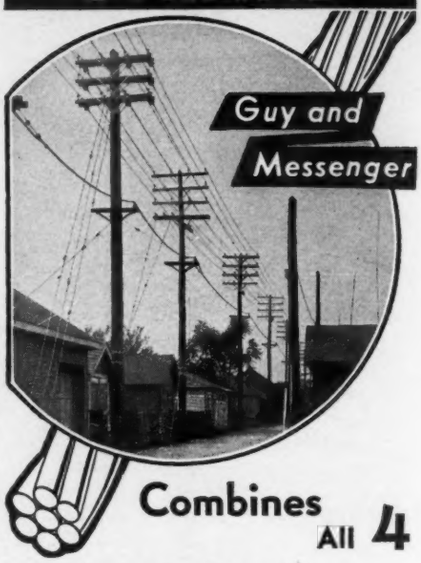
UTAH POWER & LIGHT CO. has filed with the state Public Service Commission new rate schedules for combination commercial service and municipal street lighting service at reductions of approximately $100,000 a year in power charges immediately and ultimate possible reductions of $215,000 per year. The new schedules become effective September 11. The schedule also includes provisions for automatic rate adjustments after January 1, 1942, in the event of increases or decreases in operating costs of the company because of fluctuations in commodity price levels or changes in the amount of taxes paid by the company. George M. Gadsby, president and general manager, explaining the schedules, said that the two new schedules are designed to bring about uniformity among commercial users, such as already has been achieved among residential users. The all-service schedules will make it possible for commercial consumers to obtain all types of electric service on one meter at one rate, he said, simplifying operations of the company by reducing the number of meters and the manpower needed to service them, cutting accounting costs and effecting other savings. Mr. Gadsby said similar schedules for all-service commercial and municipal street lighting rates will be filed immediately with the Idaho public service commission for the territory served by the company in Idaho.

LUZERNE COUNTY GAS & ELECTRIC CORP. was upheld by the Pennsylvania Public Utility Commission when the board dismissed a complaint against the rates and charges of the corporation filed on behalf of the Municipal Ownership Water League of Wyoming Valley, Inc., by Eugene D. Hegarty, its president. The commission dismissed the complaint because a section of the utility law provides that complaints against public utilities may be brought only by those having an interest in the subject matter. The complaint does not aver that the League is a consumer of Luzerne County Gas & Electric Corp., nor does it appear that the League has any other interest in the rates and charges of the company.

Crapo

GALVANIZED STEEL

STRAND



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1—HIGH STRENGTH
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All the inherent strength and ruggedness that steel alone provides are combined with long life and definite economies in *Crapo* Galvanized Steel Strand. Each size and grade develops the full tensile strength of the steel in its complete cross-section. The heavy, ductile, tightly-bonded zinc coating—applied by the famous *Crapo* Galvanizing Process—affords lasting protection against corrosion, extends the life of the strand beyond the normal period for replacement.

Low first cost, workability in the field, consistent, trouble-free performance and low maintenance expense characterize the service history of this time-tested product. There is a size and grade of *Crapo* Galvanized Steel Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA
STEEL & WIRE CO.
MUNCIE, INDIANA

Reclamation Bureau Lets Contracts for Power Line

Bureau of Reclamation has awarded contracts to Nehring Electrical Works of DeKalb, Ill., and Anaconda Wire & Cable Co. for two additional transmission lines to carry power to the Tucson Gas, Electric Light & Power Co. and the Imperial Irrigation District.

Nehring will furnish 360 miles of seven-strand, hard-drawn bare copper conductor for $215,729, for a 110-mile, 115-kv. line from Phoenix to Tucson, by way of Coolidge. Anaconda's low bid of $135,212.52 was for 144 miles of hollow hard-drawn bare copper conductor for a 50-mile, 161-kv. line between Blaisdell, Ariz., to power Drop No. 4 on the All-American canal.

•

Postpones FPC Hearing

Public hearings have been postponed to September 24 by the Federal Power Commission on the application of Walter H. Sammis to hold the positions of president and director of Pennsylvania Power Co. and vice-president and director of Ohio Edison Co. Mr. Sammis is now vice-president and director of Commonwealth & Southern Corp.

•

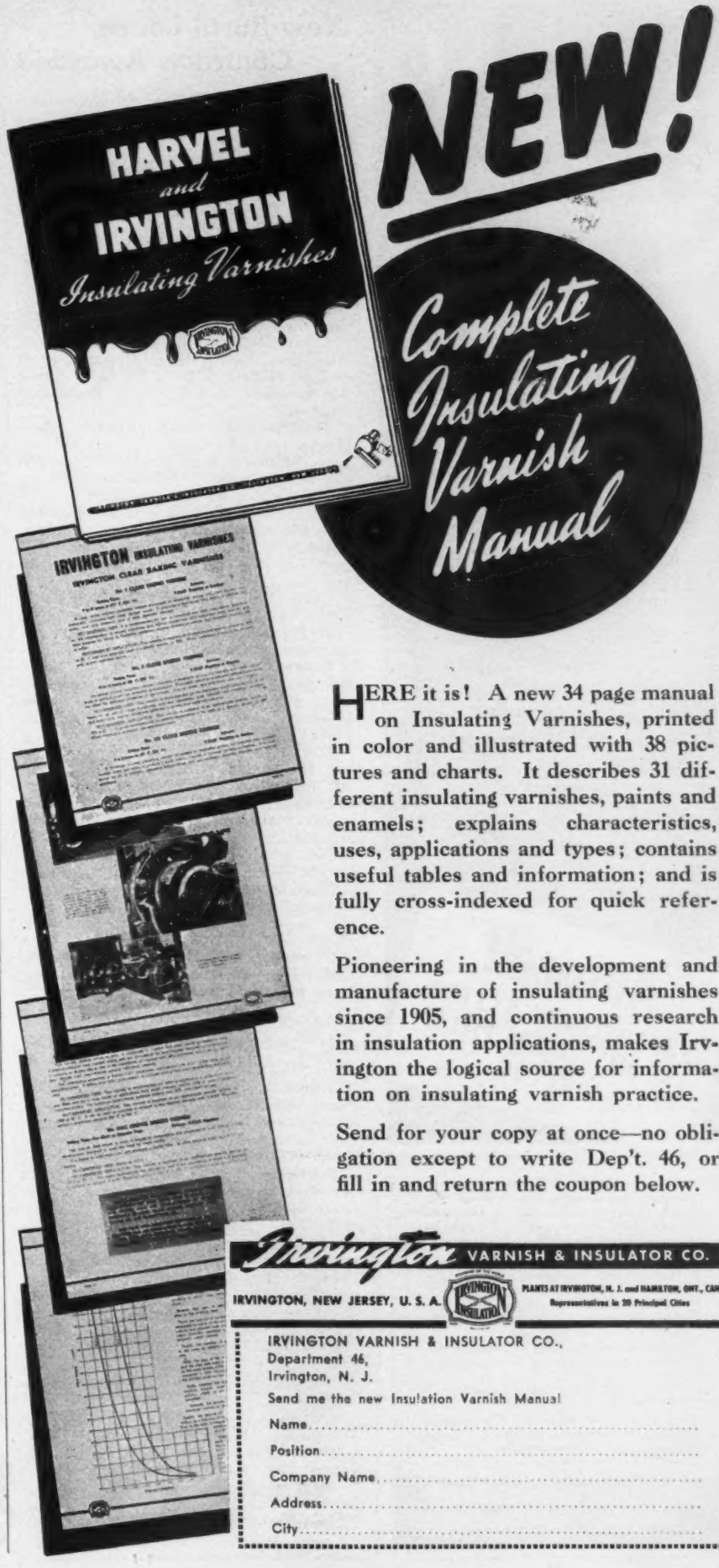
Will Sell Properties

Arkansas Utilities Commission has authorized the Arkansas Utilities Co. to sell its Green County properties to the Missouri Utilities Co. The properties include equipment in Paragould, Marmaduke and vicinity. In another order, the commission authorized the company to change its capital structure and to issue $1,000,000 in 4 per cent bonds.

Municipal Plants

ARIZONA—Willcox, the first city in the state to vote on the municipal purchase of private utilities under terms of a new law, recently decided against the proposal. The vote was 43 for and 103 against the question of buying the power plant and water system from the Southern Arizona Public Service Co. for $87,500. By a vote of 41 to 101, the electorate also rejected an accompanying proposal to issue $100,000 in bonds to finance the purchase, the bonds to be retired from revenues accruing from operation of the utilities. If the city had voted to acquire the power and water systems power would have been purchased from a near-by REA project, the Sulphur Springs Valley Co-operative.

MURRAY, IOWA—By a more than four to one vote citizens voted in a recent special election to build a municipal electric plant and distribution system to cost not more than $80,000. The city franchise with the Iowa Southern Utilities Co., has expired.



NEW!

Complete Insulating Varnish Manual

HERE it is! A new 34 page manual on Insulating Varnishes, printed in color and illustrated with 38 pictures and charts. It describes 31 different insulating varnishes, paints and enamels; explains characteristics, uses, applications and types; contains useful tables and information; and is fully cross-indexed for quick reference.

Pioneering in the development and manufacture of insulating varnishes since 1905, and continuous research in insulation applications, makes Irvington the logical source for information on insulating varnish practice.

Send for your copy at once—no obligation except to write Dep't. 46, or fill in and return the coupon below.

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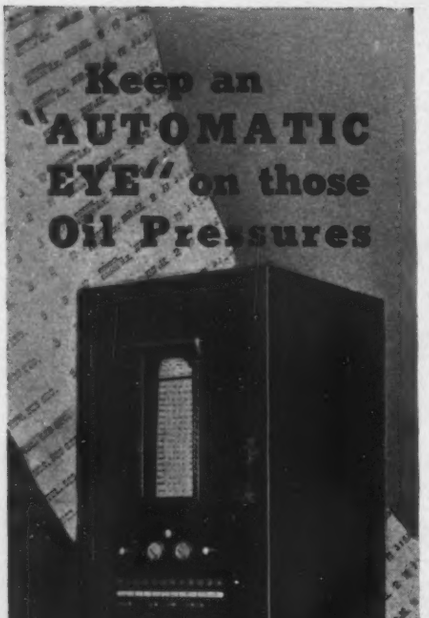

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A complete staff of electrical and mechanical engineers and physicists, available for special designs to meet individual problems.

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New Rural Loans; Contracts Awarded

Rural Electrification Administration has recently announced the following allotments:

OKLAHOMA—Caddo Electric Co-operative, Binger, Ralph G. Shaw, acting supt., $99,000 to build 163 miles of line, 341 members in Grady, Caddo, Canadian, Kiowa, Washita and Comanche counties.

PENNSYLVANIA—Claverack Electric Co-operative, Inc., Towanda, Clarence E. Jakway, manager, $230,000 to build 210 miles of line, 715 members in Bradford, Lycoming, Wyoming and Susquehanna counties.

SOUTH DAKOTA—Black Hills Electric Assn., Inc., Custer, H. H. Hawkins, co-ordinator, $108,000 to build 122 miles of line, 340 members in Custer and Pennington counties.

TENNESSEE—Tri-County Electric Membership Corp., LaFayette, Will H. Sullivan, supt., $80,000 to build 89 miles of line, 348 members in Simpson, Cumberland, Barren, Monroe and Allen counties, Ky.

TEXAS—New Era Electric Co-operative, Inc., Athens, Mrs. Eunice Bailey, president, $246,000 to build 310 miles of line, 753 members in Anderson, Henderson, Smith and Van Zandt counties.

UTAH—Beaver Valley Rural Electric Assn., Inc., Beaver, LeGrand Gale, president, $10,000 to build 12 miles of line, 43 members in Beaver County.

VERMONT—Vermont Electric Co-operative, Inc., Eden Mills, Harry D. Bowman, supt., $138,000 to build 199 miles of line to serve 471 members in Orleans, LaMoille, Franklin and Chittenden counties.

VIRGINIA—Tri-County Electric Co-operative, Leesburg, J. A. Johnston, supt., $119,000 to build 95 miles of line, 272 members in Loudoun, Fairfax and Fauquier counties.

VIRGIN ISLANDS—Virgin Island Co., Christiansted, St. Croix, Virgin Islands, B. J. Brown, president, $75,000 to expand the present system.

WISCONSIN—Washington Island Electric Co-operative, Inc., Washington Island, $51,000 for the installation of a generating plant.

WYOMING — Riverton Valley Electric Assn., Inc., Riverton, Clyde Van Dyke, supt., $10,000 to complete the system.

Among the construction contracts approved between June 24 and July 24 were the following:

NEBRASKA—Butler County Rural Public Power District, David City, Lester Trussell, manager, and Jesse C. Geiger, 11 Whitmoyer Apt., Columbus, Neb., engineer, contract to Elkhorn Construction Co., Norfolk, Neb., 41.5 miles of line, 59 members; bid, $26,204. York County Rural Public Power District, York, Howard C. Slonecker, supt., and H. H. Henningson, 626 Standard Oil Co. Building, Omaha, Neb., engineer, contract to Wright & Son Construction Co., Hebron, Neb., 34.72 miles of line, 51 members; bid, $24,565. Northeast Nebraska Rural Public Power District, Emerson, Arthur J. Budwig, supt., and H. H. Henningson, engineer, contract to Jenson and Krage, 209 Wright Bldg., Sioux City, Iowa, 159.68 miles of line, 279 members; bid, $106,800.

NEW MEXICO — Stonewall Electric Co., Albuquerque, Arthur Prager, manager, and E. T. Archer & Co., New England Building, Kansas City, Kan., engineer, contract to Richards and Mullinix, 1401 N. W. 5th St., Oklahoma City, Okla., 321.85 miles of line, 492 members; bid, $189,323.

NORTH DAKOTA — Tri-County Electric

You can SEE a Water leak.

You can HEAR an Air leak.

You can SMELL a Gas leak.

But . . . with Electricity you can't See, Hear or Smell the leak.

And that's why you should have a mechanically as well as electrically perfect connection.

A National Electric Gorilla Grip Connector will give you just that. Investigate.

National Electric
PRODUCTS CORPORATION
900 Fulton Building Pittsburgh, Pa.

Co-operative, Inc., Glenfield, L. H. Shaw, acting supt., and Ellerbe & Co., E-1021 First National Bank Bldg., St. Paul, Minn., engineer, contract to Sorkness Construction Co., Jamestown, N. D., 196 miles of line, 315 members; bid, $128,521.

OHIO—Lorain-Medina Rural Electric Co-operative, Inc., Wellington, Harry Bovard, supt., and Putnam and Woolpert, 132 N. Main St., Dayton, Ohio, engineer, contract to Davis-Hydaker Co., Spencerville, Ohio, 82 miles of line, 225 members; bid, $59,186.

OREGON—Lane County Electric Co-operative, Inc., Eugene, Ronald W. Buford, supt., and John W. Cunningham and Associates, 414 Spalding Bldg., Portland, Ore., engineer, contract to Wayman and Huenergard, 629 Park Bldg., Portland, Ore., 36.7 miles of line, 222 members; bid, $60,616.

PENNSYLVANIA — Claverack Electric Co-operative, Inc., Towanda, Clarence E. Jakway, manager, and Gibbs & Hill, Pennsylvania Station, New York, N. Y., engineer, contract to Donovan Contracting Co., 1725 Carroll Av., St. Paul, Minn., 174 miles of line, 584 members; bid, $129,303.

SOUTH DAKOTA—Whetstone Valley Electric Assn., Inc., Milbank, Banister Engineering Co., 1586 University Av., St. Paul, Minn,. engineer, contract to Zontelli Brothers, Ironton, Minn.. 189.7 miles of line, 277 members; bid, $115,369.

TENNESSEE — Tri-County Electric Membership Corp., Lafayette, Will H. Sullivan, supt., and Pat M. Sullivan, Gallatin, Tenn., engineer, contract to F. W. Owens Co., 119 N. 5th St., Louisville, Ky., 72 miles of line, 313 members; bid, $55,954. Middle Tennessee Electric Membership Corp., Murfreesboro, W. W. McMaster, supt., and Pat M. Sullivan, engineer, contract to F. W. Owens Co., 66.5 miles of line, 204 members; bid, $52,878. Upper Cumberland Electric Membership Corp., Carthage, W. E. Landers, supt., and Pat M. Sullivan, engineer, contract to Roy Richards, Carrollton, Ga., 100 miles of line, 405 members; bid, $77,160.

TEXAS — Panola-Harrison Electric Co-operative, Inc., Elysian Fields, K. A. Crawford, supt., and Freese and Nichols, 407 Capps Bldg., Fort Worth, Tex., engineer, contract to L. O. Brayton and Co., Dyersburg, Tenn., 101.7 miles of line, 198 members; bid, $57,429. Coleman County Electric Co-operative, Inc., Coleman, S. R. Hale, supt., and Freese & Nichols, 407 Capps Bldg., Fort Worth, Tex., engineer, contract to Walco Engineering & Construction Co., 2408 East 4th Place, Tulsa, Okla., 84.4 miles of line, 156 members; bid, $42,911. Cap Rock Electric Co-operative, Inc., Big Spring, Orval B. Bryan, supt., and Price & Hawk, Lubbock, Tex., engineer, contract to McClure Electric Co., 808 N. Good St., Dallas, Tex., 27.5 miles of line, 38 members; bid, $15,326. Brazos River Transmission Electric Co-operative, Inc., 4613 Camp Bowie Boulevard, Fort Worth, H. B. Gieb & Co., 1207 Texas Bank Bldg., Dallas, Tex., engineer, contract to Taylor Construction Co., Box 648, Taylor, Tex., 320 miles of transmission lines; bid, $567,376.

VIRGINIA—Accomack Northampton Electric Co-operative, Parksley, W. B. Irby, Jr., supt., and Welles Engineering Co., Front Royal, Va., engineer, contract to Rockingham Construction Co., Inc., Harrisonburg, Va., 293 miles of line, 1216 members; bid, $225,810.

WASHINGTON—Inland Empire Rural Electrification, Inc., 412 Hutton Bldg., Spokane, Victor P. Campbell, supt., and Charles H. Shouse, 416 Hutton Bldg., Spokane, Wash., engineer, contract to Washington Asphalt Co., 309 West 39th St., Seattle, Wash., 251.90 miles of line, 231 members; bid, $156,345.

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Over the high lines that stretch along the Columbia to Vancouver then across the river and down into Oregons Willamette Valley the gigantic voltages of Bonneville must flow uninterruptedly. Two 48,000 K.V.A. generators and one 5,000 K.V.A. below the controlled waters of Bonneville Dam hum under the positive fire protection of C-O-TWO. South, over the high Sierras and past the scorching wastes of the Mojave Desert to Colorado River, Boulder Dam hurls out electric energy. The two 82,500 K.V.A. generators and switch controls are C-O-TWO protected against fire. Two of the worlds largest electrical power projects—both C-O-TWO protected.

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DUXSEAL
an all-purpose sealing compound for the electrical industry

Single-Unit Plant for One-Man Operation

[*Continued from page* 43]

system. Cooling water at 55 deg. F. for the 2,750-sq.ft., two-pass reverse flow condenser is supplied from three deep wells of 1,500 g.p.m. capacity located on the plant property. Pumping is automatically controlled by a thermostat on the condenser controls. Only one of the three wells is required to supply water for light load. The thermostatic arrangement cuts a second well in and out, automatically with changes in load. The third well is a standby. Indicating lights on the boiler control panel show which wells are in operation.

Discharge from the condenser is delivered to a diversion box containing a weir that maintains a seal on the discharge line, reducing the pumping head. This weir may be raised to elevate the water level in the box to a point where it will flow through an outlet and provide irrigation water for adjacent areas under cultivation. Water overflowing minimum weir discharges through a culvert to the city storm sewer.

Boiler Operation

Automatic features are also involved in boiler operation. Boiler at the plant is a 45,000-lb.-per-hour, three-drum bent tube unit with water wall for rear furnace wall opposite the two Peabody gas burners and bare tube economizer with 1,250 sq.ft. of surface. It has a bare tube convection superheater to give 760 deg. F., total temperature at 410 lb. psi. at the outlet at full rating.

Forced draft is provided by a single inlet, single-width fan driven by a 20-hp. squirrel-cage motor through a V-belt drive. Induced-draft fan is double inlet, two-thirds double-width unit with V-belt drive from scoop-type hydraulic coupling direct connected to a 40-hp. squirrel-cage motor. Induced-draft fan discharges to a steel stack extending 18 ft. above the roof.

The boiler control panel, shown, is located on the operating floor between the boiler and turbine. It comprises a combination oil and gas automatic combustion control, boiler operating and recording instruments and controls, as well as an alarm system.

Combustion control system consists of three balanced beams, top beam balancing steam pressure

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against fuel flow, either gas or oil, and controls fuel input, through remote motor valves; a second beam balances fuel flow against forced-draft pressure or air flow and controls forced-draft fans; the third beam balances against furnace draft and controls induced-draft coupling to maintain constant furnace draft.

Push-button stations on the boiler panel control fans, well pumps and fuel oil pumps, while indicating pressure gages showing fuel gas pressures and fuel oil pressures are located on the panel also.

Alarm System

An alarm system is provided with single-pole, double-throw, Mercoid pressure or float switches operating on boiler feed pressure, fuel gas pressure, fuel oil pressure, condensate storage tank level and condenser hotwell level, also a relay on power supply to the combustion control. These are wired to red indicating lights on the boiler panel and a horn such that under proper operating conditions the indicating lights are illuminated. Irregular conditions at any of the above points will extinguish the light from that circuit and sound the horn. Indicating lights are also provided to show which feed pump and which hotwell pump is in operation. This system operates on direct current from station control battery. An emergency stop system is also incorporated in the combustion control. This system is arranged so that a failure of forced draft, induced draft, or fuel pressure will shut off fuel until the trouble is remedied and the unit reset manually.

•

Increases Field Staff; Opens Detroit Office

Increased demands for metering and control equipment to operate steam power and process plants has necessitated an enlargement of Bailey Meter Co.'s field engineering staff. The following engineers have recently been assigned to field duty: L. L. Melick to New York; J. F. Triolo to Philadelphia, G. M. Wallace to San Francisco, B. F. Elias to Cincinnati, and D. E. Smith to Buffalo.

The company announced the opening of a Detroit branch office on July 1. This office, which is located in the Curtis Building, is under the management of N. M. Barnett, assisted by R. F. Hanson and R. T. Cowan.

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with the MAGNETROL ALARM SYSTEM . .

Again the Fred H. Schaub Engineering Co. makes a protective device contribution that has at once become a "signal" success. It gives every utility an opportunity to have a positive, foolproof, "double check" system on its transformers. The most common method of operation includes a Magnetrol unit attached to a transformer with a green light that glows continuously when all is well and a bell that sounds a warning when trouble occurs—both located where operator can see and hear at all times.

With the Magnetrol, many combinations of control may be had in which both visual and audible signals may be used. Also a simultaneous alarm and oil breaker cut-out can be employed. Packless magnetic operating principle assures positive operation and eliminates oil seepage.

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The moment light goes out a bell will sound its warning so that you have immediate knowledge of trouble and can save what would otherwise be a large equipment loss.

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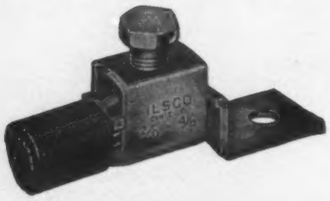

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Metering 4-Wire, 3-Phase Delta Services

[*Continued from page* 59]

where the neutral wire is not available, one company provides an artificial neutral by connecting an autotransformer having a mid-tap across the proper phase at the metering installation. This provides a well-established neutral point which may be more reliable than a ground on customers' premises.

Conclusion

The purpose of the foregoing discussion has been to present the outstanding features of four-wire, three-phase, delta metering and to describe the many applications of metering to such services. No attempt has been made to establish rules or procedure as standards to follow. Instead, the discussion has primarily aimed to assist the meterman in solving his own problems relating to the subject in the most efficient manner, and to enable him to select the proper type of metering from the viewpoints of accuracy, maintenance and economy in accordance with his own individual conditions.

•

Sale of Associated Gas Subsidiaries Completed

Denis J. Driscoll and Willard L. Thorp, trustees of Associated Gas & Electric Corp., have been advised of the consummation of the sale of two small subsidiaries by Central U. S. Utilities Co., subsidiary holding company of Associated Electric Co., an Associated Gas & Electric Corp. subsidiary.

Except for one transmission line, the property of Associated Maryland Electric Power Corp., distributing electricity in the northern part of Garrett County, Md., has been sold to the Potomac Edison Co., Washington, D. C., for a base price of $85,000.

Most of the property of Texas General Utilities Co., selling electricity and some ice in the towns of Newton and Kirbyville, Tex., has been sold to Universal Electric Construction Co., Guntersville, Ala., for a base price of $30,000.

•

Occupies New Building

A new building to increase its floor space 300 percent is now occupied by C. P. Clare & Co., Chicago. This is the second major expansion of the company in the last four years.

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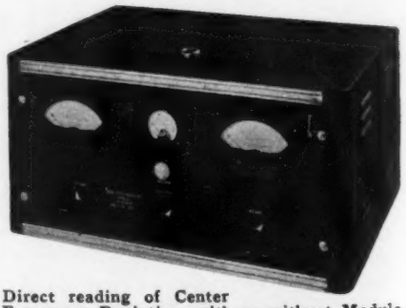

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M.I.T. to Construct New Facilities for Research

President Karl T. Compton of the Massachusetts Institute of Technology announced recently that work will be started immediately on a 38,000-sq.ft. research laboratory building to cost $260,000 and to be occupied early next November in order to relieve pressure from the defense program on other parts of the institute plant in Cambridge, as well as to provide flexible accommodations for different kinds of investigations now distributed about the property.

"At present," said Dr. Compton, "a large number of research and development projects for government and industry are under way at the institute. More than 50 percent of these are being prosecuted at the request of governmental defense agencies, and the remainder have been brought to us by industries engaged in defense work. In addition, we are offering many intensive defense training programs designed to prepare men for service with manufacturers and federal agencies."

•

New Burndy Truck

Burndy Engineering Co., Inc., has put into service its new "Queen of the Road" display truck. There are six panels holding connectors representative of the entire Burndy line. Advertising material, price sheets, installation tools and additional sample connectors are carried. Larry Lyons, electrical engineer, is pilot of the truck. Mr. Lyons will take "Miss Burndy II" on a two-year tour through the United States.

•

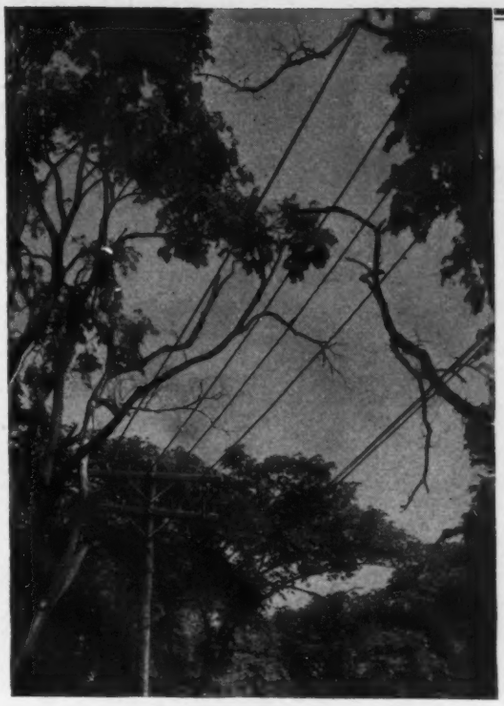
Award Welding Prizes

Cash prizes totaling $200 or more every month are being offered for interesting news items about arc-welding applications in a contest being sponsored by Hobart Brothers, Troy, Ohio. A first prize of $100, second of $50, third of $25, fourth of $15 and fifth of $10 are distributed every month. Additional special awards from $1 to $10 are awarded entries deemed worthy of purchase by contest judges.

•

LCRA Lets Contracts

The Lower Colorado River Authority, Austin, Tex., has awarded a contract to Allis-Chalmers Manufacturing Co. at $30,000 for regulators and to Westinghouse Electric & Manufacturing Co. at $17,803 for circuit breakers, both for station on Lower Colorado River project.



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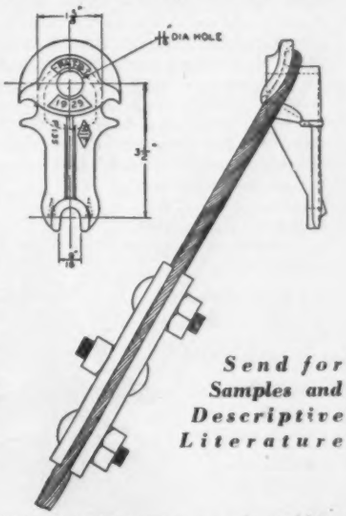
Simplified Guying Specifications

A new circular available on request features suggestions for Simplified Guying Specifications based on three simple galvanized malleable castings — M.I.F. P135 Through-bolt Guy Hook as illustrated, P128 Thimbleless Eye Nut, and P143 Curved Ribbed Washer — which users definitely rate equivalent to standard ⅝" bolts and guy strands with which they are used. A logical starting-point for Through-bolt Guying is provided when a ⅝" through-bolt constitutes the means for applying corner or dead-ending stresses against which pole must be guyed — then, using suitable attachment on other end of same bolt.



Test competitively with present guying specifications by sending assorted trial order at following 100-lot F.O.B. Branford prices:

P135 Guy Hook . . . $18.20/C	P126B Bolt Eye . . . $24.50/C
P128 Eye Nut 14.70/C	PA128-6 Anchor Rod 66.70/C
P143 Curved Washer 7.70/C	(⅝" x 6 ft. Thimbleless)

Or, we will send sample P135, P128, and P143 without charge or obligation in response to request on Operating Company letterhead.

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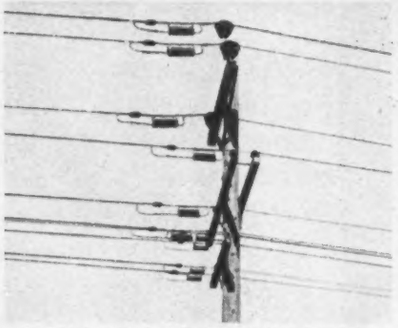

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Recipe For Preventing Priorities Shutdowns

[*Continued from page 62*]

dustry to determine what lines of defense work it can readily take on and how much business it should have to displace lost civilian production (ELECTRICAL WORLD, August 16, page 6). Similar studies of other appliance fields are listed for early action; the industries themselves can properly push them through the electrical manufacturers' industry committee and both field and Washington offices of DCS, as may be appropriate.

Community Pools

Also, DCS is actively participating in and eager to promote formation of community "mother hen" associations of assorted industrial concerns to undertake cooperative production of military items and of community "pools". In York, Pa., 43 companies have clubbed together and obtained some $30,000,000 in defense orders. There is the General Industries Company, in Elyria, Ohio, which united fifteen subcontractors in nearby towns to manufacture fuses. Acting upon a DCS recommendation, the War Department recently ordered one million 37-millimeter shell cases from the Aluminum Goods Manufacturing Company of Manitowoc, Wis., a firm employing 4,000 persons, chief support of the community and threatened with shutdown because it couldn't get aluminum for trays and tea kettles. Other efforts, in other communities, for the most part have not been nearly so successful as even these modest beginnings. Officials blame this both upon a lack of initiative among private concerns and upon the previous Army-Navy lethargy toward spreading orders among "unfamiliar" suppliers.

It remains now to be seen whether this new system works in anywhere near the degree necessary to prevent a tragic ruination of many segments of American industry which the military branches of the government finally realize is just around the corner. The "prophets" of a few months ago have won their way to the point of getting administrative machinery created which is designed to keep the wolf out of the doorways of companies to which priority restrictions deny access to raw material supplies.

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Sales Opportunities

CLEVELAND, OHIO—Cleveland Electric Illuminating Co. has completed plans for new indoor-type power substation, 60 x 120 feet, at 19314 Nottingham Road, and will proceed with erection at once. Cost reported over $80,000, with transformers, switchgear and accessories.

AUSTIN, MINN.—Board of Water, Electric, Gas and Power Commissioners receives bids until September 26 for new steam-generating unit for installation in municipal power plant, where extensions and improvements will be made. New unit is to have a rating of 100,000 pounds of steam per hour. Appropriation of about $200,000 is available for program. Helmick, Edeskuty & Lutz, Essex Building, Minneapolis, Minn., are consulting engineers.

FORT PECK, MONT.—United States Engineer Office, Missouri River Division, 10 East Seventeenth Street, Kansas City, Mo., plans early call for bids for construction of superstructure for hydroelectric power station at Fort Peck, including surge tank building and auxiliary structures, with installation of certain equipment. Plant will have an initial capacity of 50,000-kw., with structure designed for an ultimate output of 105,000-kw.

MOBILE, ALA.—Alabama Shipbuilding & Drydock Co. plans installation of motors and controls, transformers and accessories, switchgear, duct lines, electric hoists, electric cranes, conveyors and other equipment in connection with shipyard expansion, to include a series of eight new shipways, outfitting docks, mechanical and woodworking shops, and miscellaneous structures. Cost estimated about $8,000,000. Fund in this amount will be provided by Government for project, through United States Maritime Commission, Washington, D. C., which will use the facilities for construction of federal vessels.

BUFORD, N. D.—Bureau of Reclamation, Denver, Colo., receives bids until September 15 for 2300-volt motor-control equipment for Buford-Trenton pumping station, Buford-Trenton project, N. D. (Specifications 1559-D). Equipment will be installed by government.

MASSILLON, OHIO—Ohio Public Service Co., Cleveland, Ohio, will make extensions and relocation of certain power lines at Massillon for service for local Federal project, and has secured contract from government for work at $16,096.

LOUISIANA, MO.—Hercules Powder Co., Delaware Trust Building, Wilmington, Del., plans installation of motor-generator sets, motors and controls, regulators, switchgear, duct lines, industrial lighting system, conveyors and other equipment in new plant at Louisiana (Pike County), for production of synthetic ammonia for Government. It will comprise a large group of one and multi-story production units, with shops, warehouses, administration building and miscellaneous structures. A power substation will be built on plant site for central station electric service. Cost estimated at $17,000,000 and fund in that amount will be secured through Defense Plant Corporation, Washington, D. C., a federal agency, for project. Bechtel-McCone-Parsons Corp., 601 West Fifth Street, Los Angeles, Calif., engineer, will be in charge of design and erection of plant. Work is scheduled to begin early in fall.

TOLEDO, OHIO—Toledo Edison Company is said to have plans nearing completion for addition to steam-electric power station, with installation to include a 50,000-kw. turbine-generator unit and accessories, high-pressure boiler and auxiliary equipment. This will be part of an expansion and improvement program to cost about $6,000,000, including extensions in transmission and distributing lines, power substations and other facilities for increased service in different parts of city.

BREMERTON, WASH.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until December 16 for 63,150 lineal feet of stranded copper cable, 2500 lineal feet of single-conductor wire (Schedule 8520). Also, at the same time, for 2200 lineal feet of zinc-coated rigid steel conduit (Schedule 8521); and, at same time, for quantity of porcelain insulators, vertical bar clamps, flat wall mounting clamps, tee connectors, single pole switches, bus bar clamps, copper bus bars, welders' boxes, conduit fittings, lighting panel and lighting fixtures, and other electrical apparatus and fittings (Schedule 8519), all for Puget Sound navy yard, Bremerton.

MINNEAPOLIS, MINN.—Northern States Power Co. will soon begin construction of steel frame superstructure for addition to steam-electric generating station, where expansion will be carried out, as previously noted in these columns. New turbine-generator unit and auxiliary equipment will be installed. Work is scheduled for completion in 1942.

DENISON, TEX.—Texas Power & Light Co. Denison, plans extensions in 12,000-volt transmission line to point near Pottsboro, about eight miles distant, where service will be furnished at a new government flying school and depot. A terminal substation will be installed for step-down service for local distribution.

CARBONDALE, ILL.—Sherwin-Williams Defense Corp., recently organized subsidiary of Sherwin-Williams Co., Inc., 101 Prospect Avenue, N. W., Cleveland, Ohio, manufacturer of paints, varnishes, etc., plans installation of motors and controls, transformers and accessories, switchgear, duct lines, industrial lighting system, electric hoists, loaders, conveyors and other equipment in new plant at Orchard Lake, near Carbondale, for bomb and shell-loading service for War Department, Washington, D. C., to be known as Illinois Ordnance Works. It will comprise a large group of one-story buildings, with warehouses, mechanical shops and miscellaneous structures. A steam power house is planned. Entire project will cost over $35,000,000, and appropriation in required amount for land, buildings and equipment will be furnished by Defense Plant Corporation, Washington, a federal agency, which will hold title to property. Work is scheduled to begin soon.

FORT DODGE, IOWA—Fort Dodge Gas & Electric Co. has begun excavations for addition to local steam-electric generating station, where expansion will be carried out, and will proceed with superstructure at early date. Equipment will be installed late in the fall. This is part of an extension and improvement program in city, estimated to cost about $1,000,000, including transmission and distributing lines, power substations and other facilities for increased service.

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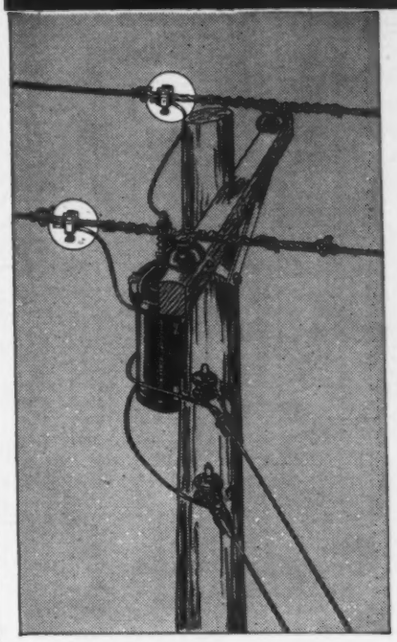

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LETTERS TO THE EDITOR

Reclamation of Insulating Oils

To the Editor of ELECTRICAL WORLD:

I have read an interesting article in the July 26 issue of ELECTRICAL WORLD relating to the reclamation of insulating oil. There are some errors in the data given concerning the dielectric test.

Reference is made to the ASTM method as D-48-33. This method does not apply to insulating oil, but to molded electrical insulation. Reference should be made to D-117-40. The authors also give data concerning the effect of water. Since their data are at variance with recently published information, I wonder if it is the result of their own experiment or whether they are quoting from other sources. I would refer them to an article by F. M. Clark in *Electrical Engineering*, August, 1940, page 433, Fig. 13. It will be noted that a proportion of ten to twenty parts per million of water has very little effect in reducing the dielectric strength.

At present the ASTM is doing considerable work on dielectric strength and sludge formation in its Committee D-9 on electrical insulation.

E. J. RUTAN, Secretary
Committee D-9 on Electrical
Insulating Materials A.S.T.M.

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More "Different"

To the Editor of ELECTRICAL WORLD:

I wish to take this means of congratulating you on your editorial "Different," appearing in the August 9 issue of ELECTRICAL WORLD.

For at least the last eight years the subject of your editorial has been obviously the electric utility's greatest need. Follow up this fine thought with "more" and "more" until it finally takes effect.

R. E. MCDONOUGH,
Manager of Commercial Sales
Montana Power Company, Butte.

•

Plans Mobile Power Units

The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to assemble and equip two complete mobile electric power plant units, railway mounted, for service at yard properties as may be required. Cost is estimated at $2,500,000.

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P-945, Electrical World
520 No. Michigan Ave., Chicago, Ill.

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UNUSUAL OPPORTUNITY for recent graduates in electrical engineering to learn all phases of electrical design of large power stations and substations, with large engineering and consulting organization in New York City. Give full particulars, age, nationality, education, previous experience if any, and salary expected. P-946, Electrical World, 330 W. 42nd St., New York, N. Y.

DRAFTSMEN: Electrical, experienced generating station and substation. Location New York City. State experience and salary desired. P-955 Electrical World, 330 W. 42nd St., New York, N. Y.

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EXECUTIVES AND TECHNICAL MEN. Qualified candidate desiring $2,500 to $20,000 position may contact employers through our confidential services, established 26 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

ELECTRICAL ENGINEER—18 years experience with large Utility on independent power supply and distribution studies, station design, material specifications and general engineering problems desires change, practical and resourceful. PW-948, Electrical World, 330 W. 42nd St., New York, N. Y.

POSITIONS WANTED

ELECTRICAL ENGINEER—11 years utility experience, desires responsible position with Operating Division of Power Company. Age 33. PW-953, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

REGISTERED PROFESSIONAL ELECTRICAL Engineer, 1925 Graduate Domestic and Foreign Public Utility. Experience in Distribution and Transmission Engineering. Now employed desires change in position. PW-954, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

OFFICIAL PROPOSALS

Bids: September 23 (79)

Bowman Transmission Line

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
SANTEE-COOPER PROJECT
DOCKET NO. 4329-P-R

1. TIME AND PLACE OF OPENING BIDS: Sealed proposals for constructing the Bowman Transmission Line will be received by the South Carolina Public Service Authority at the office of the Secretary, Peoples Building, Charleston, S. C., until 10:00 A. M., September 23, 1941, at which time all proposals will be taken to the Fort Sumter Hotel where they will be publicly opened and read.

2. PROCUREMENT OF PLANS AND SPECIFICATIONS: Proposals must be submitted on the forms furnished by the Authority. These forms, including the plans and specifications and other contract documents, will be available and can be obtained on or after September 5, 1941, from the Office of the Secretary of the Authority, Room 508, Peoples Office Building, Charleston, S. C., upon payment of $10.00 for the first set and $3.00 per set thereafter. No refund will be made. These documents may also be examined free of charge at the offices of the Authority, Columbia, and Charleston, S. C.; at the offices of the Associated General Contractors, Columbia, S. C., Charlotte, N. C., Raleigh, N. C., Atlanta, Ga.; and at the plan room of the F. W. Dodge Company, Atlanta, Ga.

Lists of prospective bidders and interested parties will be supplied to any manufacturer or person desiring to subcontract for a part of the work upon application to the Secretary of the Authority.

3. DESCRIPTION OF THE WORK. The main switchyard of the Santee-Cooper Project is located near the Pinopolis Power Plant, about thirty-two miles northerly of Charleston and four miles north of Moncks Corner, South Carolina, and the transmission line covered by the specifications will connect the switchyard with Bowman, South Carolina.

The contractor will be required to furnish material and erect, complete and ready to operate, approximately forty-five miles of 115 KV, 3 phase, 60 cycle, single circuit, No. 4/0 Copperweld-Copper Conductors, wood pole, H-frame transmission line, with overhead shield or ground wires and counterpoise where required. The Authority has placed orders for conductors, shield wire, guy wire and ground wire, as required by the specifications, which material is to be paid for and used by the contractor in the performance of the work.

4. BIDDER'S BOND: Each bid must be accompanied by a certified check or bidder's bond executed by the bidder and a surety company licensed to do business in South Carolina and Countersigned for the Surety by an agent or attorney-in-fact who is a bona fide resident of the State of South Carolina, in the sum or not less than five percent of the amount of the bid. This is

(Continued on opposite page)